SCIENTIFIC AMERICAN

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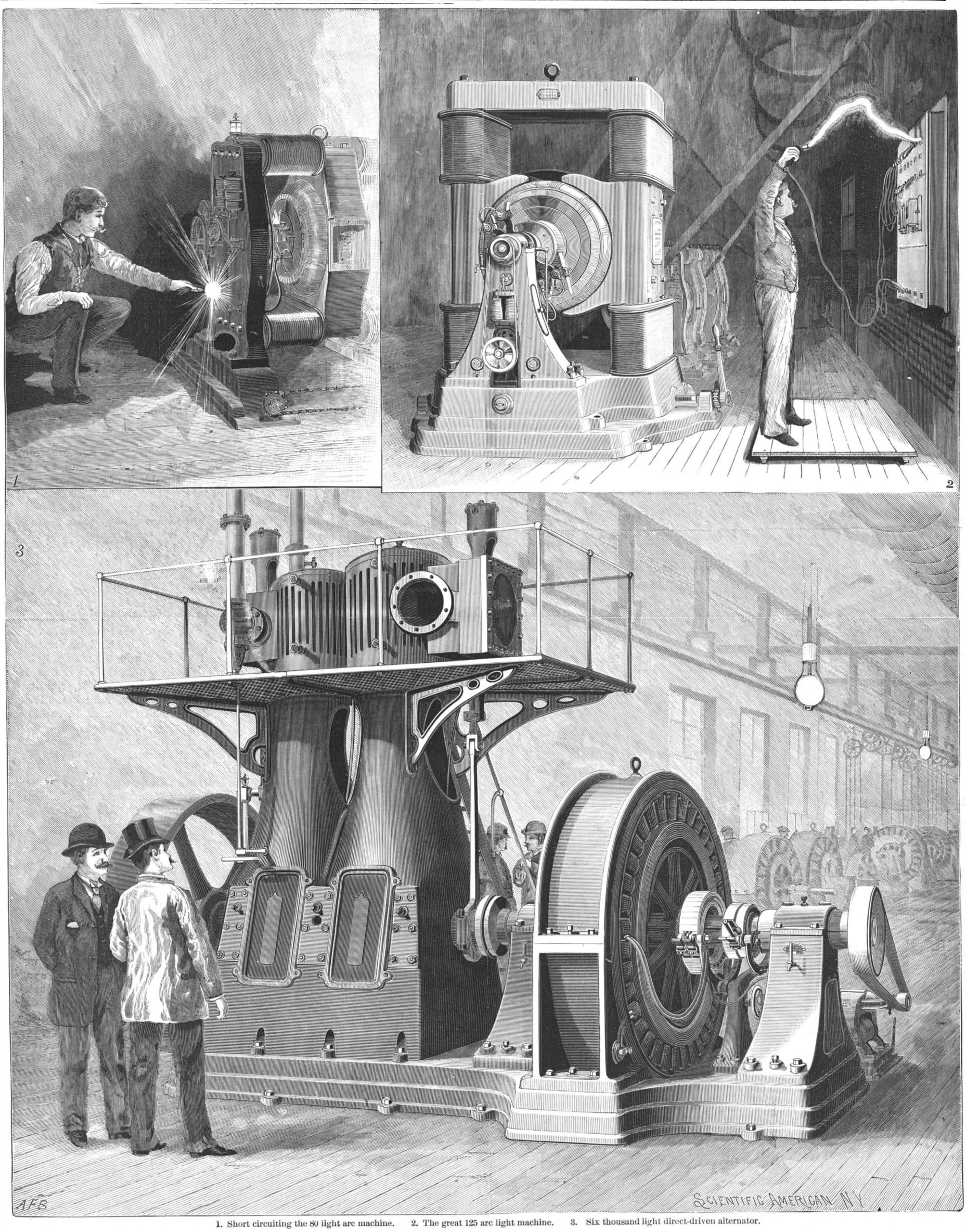
A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. LXXI.—No. 14. ESTABLISHED 1845. | NEW YORK, OCTOBER 6. 1894. | $3.00 A YEAR. WEEKLY.



1. Short circuiting the 80 light arc machine. 2. The great 125 arc light machine. 3. Six thousand light direct-driven alternator.

THE FORT WAYNE ELECTRIC CORPORATION—THE WOOD DYNAMOS.—[See page 219.]

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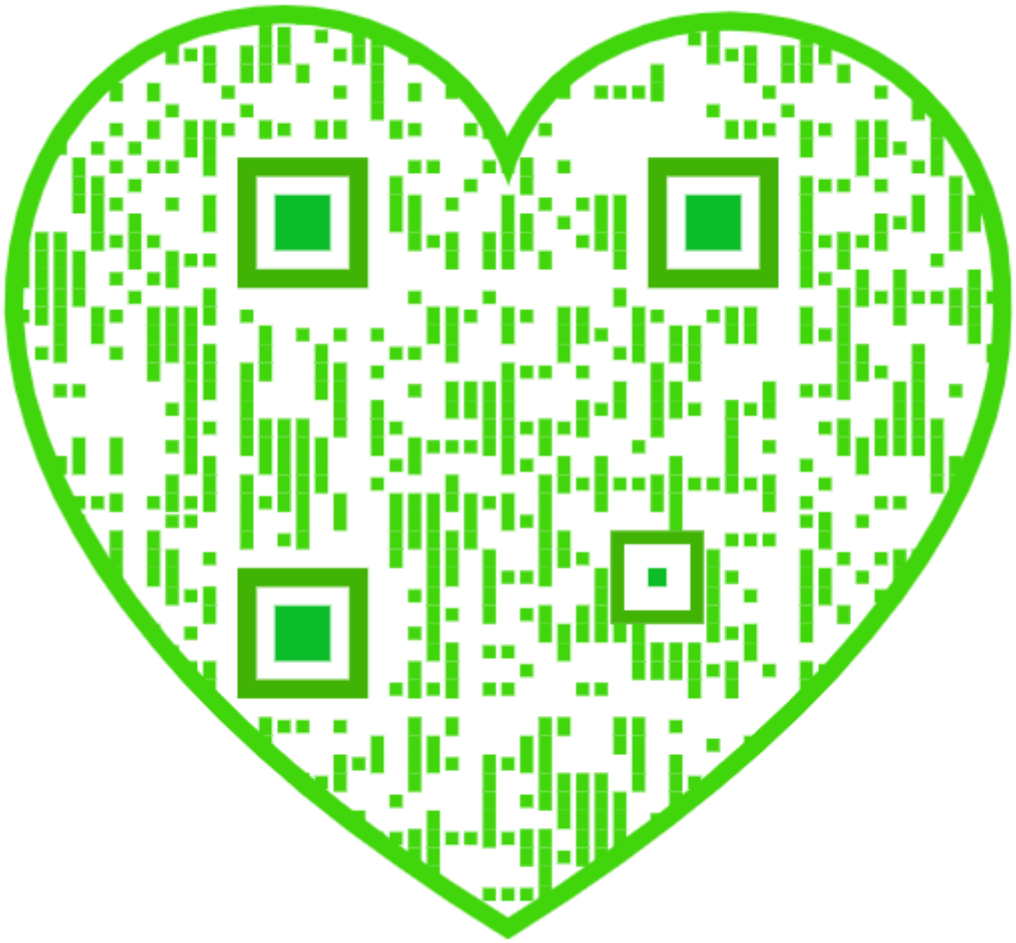

Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

No. 361 BROADWAY, NEW YORK.

O. D. MUNN. A. E. BEACH.

TERMS FOR THE SCIENTIFIC AMERICAN.

One copy, one year, for the U. S., Canada or Mexico.....$3 00
One copy, six months, for the U. S., Canada or Mexico..... 1 50
One copy, one year, to any foreign country belonging to Postal Union. 4 00
Remit by postal or express money order, or by bank draft or check.
MUNN & CO., 361 Broadway, corner of Franklin Street, New York.

The Scientific American Supplement

is a distinct paper from the SCIENTIFIC AMERICAN. THE SUPPLEMENT is issued weekly. Every number contains 16 octavo pages, uniform in size with SCIENTIFIC AMERICAN. Terms of subscription for SUPPLEMENT, $5.00 a year, for the U. S., Canada or Mexico. $6.00 a year to foreign countries belonging to the Postal Union. Single copies 10 cents. Sold by all newsdealers throughout the country. See prospectus, last page.

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MUNN & CO., Publishers,
361 Broadway, New York.

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NEW YORK, SATURDAY, OCTOBER 6, 1894.

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MOTOR CARRIAGES AND GOOD ROADS.

The United States in some of its aspects, despite its great population, its large cities, wealth and inventive powers, appears susceptible of further advances. Of late agitation in directions affecting what may be termed its internal economies has been manifest, and good roads for the country districts, electric traction lines for country and city alike, and improved pavements for cities have been discussed on all sides by private citizens and by legislators. Ten years ago the steam railroad, the growth of little more than a generation, was pointed to with interest as a cause which had revolutionized the world. For in modern times the transportation of freight and of passengers is the most important business of humanity. The idea of the steam railroad was the creation of large units of transportation. Great trains of cars bearing several hundred passengers became the railway manager's ideal.

The steam railroad seems to have reached pretty nearly its limit, and now a most formidable competitor for local traffic has come upon the scene in the electric road. The five and six car steam train is supplanted by a number of single trolley cars run at frequent intervals.

These matters the capitalists have in charge. But the improvement of roads and streets affects the municipalities, the county and State authorities, and very directly the individual. For on roads and streets the horse-drawn vehicle and the bicycle travel, and the latter, once a toy and now an everyday vehicle, is a principal cause of the new agitation. With good roads all over the face of the country, and with proper city pavements, a new field of work for the inventor at once is open. The horse is being more and more relegated to the background. The bicycle surpasses him in its powers of transporting humanity. It illustrates the immense reduction of friction on journals by the use of ball bearings. After ball bearings had settled this part of the problem, the rolling friction difficulty was solved by the pneumatic tire, and the bicycle, in great measure a perfected type of machine, is going into universal use.

In France recently there has occurred a competition between road vehicles driven by power. From the early days of this century repeated efforts have been made to produce a road engine. To the existence of this machine a good road surface is essential. France is peculiarly adapted to its introduction on account of her good roads. There the bicycle is in universal use, and the power-driven road wagon may become a part of the machinery of transportation.

In the United States, with cobblestone pavements, and with sandy and muddy roads disgracing city and country alike, much has to be done before the work of producing a successful traction engine or carriage can be accomplished. But the production of the bicycle has done so much to facilitate progress, and has solved so many of the mechanical problems of the perfect road vehicle, that it seems a pity that the power problem cannot also be solved. The motor is now what is wanted. It must be light. The bicycle of twenty-five pounds weight carries a two hundred pound rider. The motor carriage of the future must be light.

With good roads all through the country traversed on bicycles by every one, and with power-driven vehicles for freight, in place of horse and wagon, the life in the country districts would be revolutionized. Daily delivery of the mail and of light express matter would become practicable, and the progress of the individual would be favored. But until good roads come this cannot be. The trolley road as an approach to the desired cheap traction has proved welcome to country and suburban dwellers. The advent of a practical power-driven vehicle coupled with good roads would prove just as welcome and more in consonance with the vested rights of the community in such roads as they possess; rights in which are now surrendered to the electric road companies with far too great readiness.

Kentucky Hemp.

Mr. James K. Reeve, in the Country Gentleman, says: In 1882 the crop amounted to about 4,000 tons; it had not varied much from this for a long time. Cheaper fibers were brought in to help meet the demand for lower priced goods, and jute and sisal for a while nearly drove American hemp from the market. The fall in price has reduced the value from $160 per ton to $100. The Kentucky crop for the present year is estimated at only 3,000 tons, but there is no prospect of an advanced value.

Besides the introduction of cheaper substitutes in the way of fibers, hemp has met disastrous competition from another source. The use of metal in the place of fibers has assumed large proportions. The first step in this direction, and one which largely curtailed the market for hemp, was the use of iron cotton ties—the straps which are used to bind the bales. Then came the introduction of steel wire cordage for standing rigging on ships. In connection with the baling of cotton, bagging made from jute butts was also adopted in place of the former hemp bagging. Thus, while its value is as fully recognized as ever, the relentless demands of competition have forced manufacturers to use cheaper substitutes, until the demand for it has almost ceased. Its principal employment now perhaps is for the adulteration of flax, with the single exception of which it is doubtless the best fiber produced.

To help the reader understand the cost of harvesting, and to realize the difficulties that are in the way of producing it more cheaply, a few words of explanation may be necessary.

From the time when the harvesting begins, which is in the latter part of August or by the first of September, a period of five or six months is required for preparing the crop for market. Generally speaking, a year may be said to intervene between the sowing of the seed and the selling of the product. The hemp is cut by hand, a knife set in at right angles to the handle being used. The work is pretty severe, as the stalks must be cut close to the ground, necessitating a constant stooping posture on the part of the workman. Cutting by machine has been tried, but it leaves a couple of inches of the butt of the stalk standing. This is just where the heaviest fiber is produced, and it is estimated that 200 pounds of fiber to the acre is lost by machine cutting. This, at 5 cents per pound, would amount to $10, which is much more than the cost of hand labor. The subsequent handling includes stacking and spreading—which consists in laying the canes out in regular rows upon the ground, to undergo the process of retting. A good crop is calculated as one that when thus spread will fully cover the ground upon which it has grown. It is left thus for some weeks, depending upon the weather, until the retting (the word is probably a corruption of rotting) has progressed so far that the pith or inner part of the cane will separate readily from the husk or fiber. The separation is then done by means of a brake, a clumsy wooden tool operated by hand, which thrashes the woody portion of the stalk out from the fiber and leaves the latter finally ready for market. All of these processes are expensive, the braking alone costing $1 per 100 pounds. The securing of the crop entails so much expense that it is quite common for the grower to secure advances of money for this purpose from dealers and manufacturers. But I am glad to say they are not under such thraldom of crop mortgages and usurious rates of interest as have been too common with another class of fiber producers in the South—the cotton growers. One of the largest buyers of hemp in Lexington told me that he was already advancing money for the payment of harvesting expenses, charging no interest and only requiring that he should be given the opportunity of purchasing the crop at its market value when ready.

After passing through the brake the hemp is twisted into a coil of about 5 pounds weight, which is called a "hand," and in this rough state goes to the dealer. In this warehouse or factory it is hackled or dressed, which is also a hand process, and is then ready for baling and shipment. In hackling, the short fiber is separated from the longer, and makes a second quality. The fine waste product is called tow, and when mixed with tar becomes oakum, which is used in calking ships.

From 800 to 1,400 pounds of hemp is considered an average crop. Even at the present price of $100 per ton, it is a crop that gives a fair money yield per acre, and might still be a profitable one were it not for the extraordinary expense of handling. As it is, farmers are preferring to grow more corn, and to make up the difference in their incomes by letting more land for tobacco.

Maxim's Flying Machine.

In reply to an inquiry whether his flying machine will fall edgeways like a kite in case the propelling mechanism should break down in the air, Mr. Maxim says:

The Anglo-Saxon kites, as made by boys in the United States and England, are rather crude affairs. They have to be provided with a tail, and, as we all know, they often fall to the ground edgeways, striking a very powerful blow in proportion to their weight. But in China men, and not boys, make and fly kites, and these kites are so perfectly made that they never fall to the ground edgeways, neither is it necessary to provide them with a tail. My flying machine is made somewhat in the form of a kite, and I have modeled it after the Chinese rather than after the Anglo-Saxon variety. It will not fall to the ground edgeways. In case the machinery should stop while it is in the air, the machine would be brought to the ground not in a vertical line, but would run down an incline on the air, striking the earth while moving ahead at a comparatively high velocity, while its vertical velocity would not be great enough to cause any serious damage to the machine or its crew.

TWENTY years ago Southern planters paid men to haul away cotton seed and burn it. Now they get from $6 to $8 a ton for it.

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Days in Rome.

We may smile at the ignorance and arrogance of the old Romans because they called their golden milestone in the Forum "umbilicus terrarum;" but after we have spent some days among her ruins, her churches and monuments, have had associations of more than twenty-five centuries recalled, and have noticed the activity and vigor in the present life of the city, we are almost, if not quite, ready to say, "Of course, Rome is the center of the world."

I presume that it is very common for travelers who come here to-day, to wish they could have come a century, or even a generation, ago, when old Rome was less obscured by the bustling capital of the young kingdom of Italy. However, there are compensations. Some of the interesting discoveries are very recent ones, and modern Romans are but repeating the history of their ancestors, in building on old foundations; the continuity is being preserved.

It is a curious fact that this city, which in the past has had the vicissitudes of war and pestilence and prosperity, is suffering now from what is known in America as a "boom." There has been over-building, banks have loaned money on security which did not secure, and unfortunate depositors are beggared. In their haste to build, too, they have forgotten that they live over enormous caverns, and some large structures have collapsed after they were finished, in much the same fashion that others have in a land that had not been dreamed of when Rome was mistress of the world.

But the general aspect of the city is decidedly one of thrift and stability. The new streets are wide, clean and well lighted; so many railway tracks run into the central station that one instinctively says, "All roads lead to Rome!" The new churches have a splendor about them that the old ones lack, albeit there is no Michael Angelo to be their architect and no Raphael to paint their Madonnas. The monument to Victor Emanuel, which is being built on the Capitoline Hill, will doubtless be grander than any other in Europe. It is to include 200 frescoes, 400 statues, and to cost 12,000,000 francs. The equestrian statue of the King will overlook not only the present city, but those wide outlying lands which were thickly populated when Rome was half as large as London now is.

And it is that Rome and her beginnings which most interests the stranger. So much and so well have the best known objects of interest been written about, that I cannot say anything new about them; the most I can hope to do is to refresh the memory of them in some readers' minds and suggest to others that it is worth while to spend a short time in Rome if one cannot do more.

With a scholarly guide, who is thorough master of the history and geography of the city, ancient and modern, a great deal can be accomplished in a week. Such a guide is indispensable to the visitor who wants to make the most of his time.

The seven hills seem to-day more traditional than real. Standing on the Capitoline, the Esquiline, the Coelian, the Viminal, the Quirinal, the Palatine and the Pincian are pointed out as quarters of the city; they differ so slightly in elevation from the valleys between them that we drive from one to another scarcely noticing any change in the level. It is hard to believe that once they were distinct and each had its own wall. The hills were never high, and Rome's masters have not scrupled to level them as they have her palaces and temples when they saw fit.

The present city is from 16 to 22 feet above the level of the ancient Forum. Some of the most interesting ruins stand upon the site of others which far antedate them. Emperors and Popes alike have sought to beautify the city or immortalize themselves at the expense of whatever they could lay hands upon.

The Coliseum, for example, was for 130 years used as a quarry, and because it was so well built that it was more labor to get stone from it than from the hills near by, the Popes not only robbed it themselves, but one of them offered a premium to any one who would take building material from it. And yet it is to-day the most impressive ruin in Rome. The outer walls are made of large blocks of travertine from the Sabine Hills; they are laid without mortar, but still are closely joined, and age has given them a soft, gray brown tone. They cover walls of enormous thickness made of brick and tufa in alternating layers.

How dazzling must it have been when these walls were covered outside and in with white marble and ornamented with tiers of marble columns! The lower columns were Doric, the next Ionic, and the third tier Corinthian. The fourth story, built by Titus, had windows separated by Corinthian pilasters. The interior marbles, which, like the exterior ones, have all been carried away to be used in other buildings, were taken from Nero's golden house, which was near. The Coliseum stands in what was his palace garden, its center, where was an artificial lake. Its present name, given in the eighth century, it is supposed, was given from the colossal statue of Nero. Before that time, it was known as the Flavian amphitheater. It will be remembered that it was begun by Vespasian in 69 A. D. and was finished in eleven years. Twenty thousand captive Jews worked upon it. It is a third of a mile in circumference, and not round, as some pictures represent it, but oval, its longest diameter about 205 yards, the less 169 yards. The height of the walls is 165 feet, and this also, I was told, is the depth of the foundation. There are four tiers of seats; the lowest was for the Emperor, the nobles and vestal virgins; the next was for the freedmen; the third, for the soldiers; and the upper row was set apart for the slaves. From 87,000 to 100,000 people could be seated, and so numerous were the entrances, and so perfect was the arrangement of the staircases for the different tiers of seats, that it is believed that the great theater could be emptied in ten minutes. The audience was protected by a movable awning which was drawn by sailors from the imperial fleet, stationed in the soldiers' tier. Some of the iron fixtures used for the awnings, or the grooves in which they were, are yet to be seen.

The arena, which measured 98×58 yards, as now seen is at two different levels. The upper one was made in the fourth century, the older one has been excavated only in part. It was the custom to keep the wild beasts in dark dens for forty-eight hours without food, before they were to fight, and then from thirty gates they bounded together into the arena. A sloping bronze wall with an ivory coping protected the sitters in the lower seats from their attacks, and slaves were stationed behind gratings, where they could strike an animal which attempted to cross this barrier. The arena was three times flooded for naval contests. After Constantine's time, gladiatorial fights were no longer allowed, but beasts still furnished entertainment to the crowds.

In the eighth century, these fights, too, had ceased, and the huge structure was used as a hospital; the wide arches supporting the walls were shut in with boards, and rows of beds were placed under them. When, in the seventeenth century, the French turned the Coliseum into a fortress, the horses were kept on the lower arena. Pope Pius VI. made a chapel of one of the 26 rooms from which the gladiators and Christians came upon the arena. The beauty of the ruin by moonlight has not been exaggerated; but only a poet can describe the scene when to the majesty of the pile dimness and mystery are added. A. D.

Rome, 1894.

The Silver Dollar.

The purchasing power of the silver dollar, which is now equal to that of the gold dollar, would be reduced if the present policy of the Treasury were abandoned. Silver dollars would remain a legal tender, but that would not preserve their purchasing power. They would have the same debt-paying power as gold, but no debts would then be paid in gold. Silver or its equivalent would be exclusively used to pay debts, and would have for that purpose the same power as at present; but when used to purchase commodities its value would be reduced, because the prices of goods, in silver, would be raised. The purchasing power of a dollar at present is the same as that of 23·22 grains of fine gold, whether in bullion or gold coin. There are 371¼ grains of fine silver in a dollar, but it requires about twice that amount of silver bullion to purchase 23·22 grains of gold bullion. This simply means that we are using the gold standard. If we had the silver standard, the purchasing power of the dollar would be that of 371¼ grains of silver bullion, which at present is about fifty cents.

The ratio of 16 to 1 of gold to silver simply means that 16 ounces of silver are of equal value with one ounce of gold. Recently an ounce of gold has been selling for as much as 32 or 33 ounces of silver; as the exact ratio varies from day to day, we will call it 32 ounces. Now it is obvious that the dollar cannot be worth at the same time the value of the gold bullion which it contains and the value of the silver bullion, since these are in the ratio of 2 to 1. It may be either, but it cannot be both. At present it has the purchasing power of the gold bullion, and the different kinds of dollars are kept at a parity, that is, at equal purchasing power, by the policy of the Treasury department, which gives to the citizen the sort of dollar which he desires. A note which calls for coin is paid in either gold or silver at the option of the holder. This prevents gold coin from going to a premium.

Free coinage means that the government shall take 371¼ grains of silver, worth about fifty cents, and give a dollar for it. Whenever that happens it will be impossible for the Treasury to pay out gold and silver without distinction. Gold will then only be obtainable from private individuals, and will go to a premium, while silver dollars will have the same purchasing power as 371¼ grains of silver bullion. Free coinage advocates say the price of bullion will rise. Possibly it might rise 10 per cent; if so, the purchasing power of the dollar would be 55 per cent of what it is now. If it rose 20 per cent, its purchasing power would be 60 per cent of what it is now. In order for the dollar to retain its present purchasing power, it would be necessary for silver bullion to rise 100 per cent, and this is extremely improbable. It is quite probable that the adoption of the silver standard would put up the price of siver bullion for a time. The passage of the Sherman act in 1890 put up the price of silver to $1.21 an ounce in about a month. Then it began to recede, and it is now from 64 to 65 cents. Probably something of the same sort would follow free coinage, but in the end the purchasing power of the dollar would probably not be materially higher than the present price of 371¼ grains of silver bullion. Our adoption of the silver standard would slightly increase the demand for silver, but it would not be equal to the demand which existed prior to 1873. Hence the need of an international agreement as to the use of silver and its ratio to gold.—Louisville Courier-Journal.

The Quince.

The quince, says a writer in the New York Weekly Tribune, is one of the most valuable fruits we have for preserving, though it can be used for little else, except to add flavor to the plain dish of apple sauce. The best quinces are the large apple quinces, which make such beautiful red preserves. Some fable says that the quince, and not the orange, was the golden apple of Hesperides. Certain it is that the quince is one of the oldest of fruits, and was in use in early English times, and even in ancient Greece.

Quince jelly is one of the easiest jellies made, and therefore one of the best for the amateur to attempt. Cut the quinces into bits, without peeling them, and put them in a porcelain kettle with a little water in the bottom to prevent their burning. Put in all the cores that are not wormy. Cover the quinces closely and let the juice gradually draw out, until the whole mass is a soft liquid pulp. Squeeze this pulp through a linen cloth, and measure the juice. To every pint of juice add a pound of sugar. Boil up the sugar and juice until they turn to a jelly. It requires to be boiled from half to three-quarters of an hour, according to the amount of water that was added. Long boiling tends to make the jelly light and clear colored, but it should not boil long enough to be stringy and tough.

A most delicious jelly is made of one-half pound pippins and one-half quinces. This apple and quince jelly is more delicate than a jelly of pure quinces, and is especially nice for layer cakes and puddings. For jelly use the ordinary small quince or the large smooth quince.

To preserve quinces, core, pare, and quarter them. Lay aside the cores and parings and any imperfect piece for marmalade. Drop the pared quinces in boiling hot water and cook them until they are just tender enough to pierce with a straw. Then put them in bottles. Make a sirup of the strained water in which the quinces have been cooked, allowing two pounds of sugar to a pint of water and three-quarters of a pound of sugar to every pound of quinces. When this sirup is boiling hot pour it over the quinces in the jars. Seal them up and cook them for ten minutes longer, the jars set in water boiling around them. A rich, well-flavored quince treated in this way makes a preserve in which the sirup forms a light jelly around the pieces of quince.

To make a nice marmalade, add about one-quarter pippin apple to the skins, cores and pieces laid aside. Add any water left in which the quinces are boiled. Let the fruit boil for half an hour, then strain it through a colander fine enough to strain out all the seeds, but coarse enough to allow the pulp to go through. Allow three-quarters of a pound of sugar to a pound of fruit, and let the whole mass boil for an hour and a half longer.

A Rainbow Show Bottle.

To prepare this, first ascertain the capacity of the bottle and divide by 7, to find the volume of liquid required for each layer. Then take sulphuric acid to begin with, and tint it blue by the addition of indigo sulphate. For the next layer use chloroform; for the third use glycerine tinted with caramel; for the fourth castor oil colored with alkanet root; for the fifth, proof spirit tinted with green aniline; sixth, cod liver oil, containing 1 part of oil of turpentine to 99 of the fish oil; seventh, rectified spirit tinted with violet aniline. Each of these should be poured in through a tube, the lower point of which should be directed against the side of the bottle, so that the liquid may trickle gently over the surface of the layer below it.—National Druggist.

A Co-operative Rolling Mill.

The result of an attempt to operate a rolling mill at Hubbard, O., on the co-operative plan is interesting. After paying up all outstanding indebtedness there was a surplus of about 25 per cent to distribute to the stockholders out of the 50 per cent of the wages that have been retained by the managers to create a capital. This is equivalent to a reduction of 25 per cent in wages for the time that the mill was in operation. In other words, in order to get out even the company could only afford to pay 75 per cent of the wage scale. Doubtless the hard times was the cause of this ill success.

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THE LONG-RUNNING METEOROGRAPH OF THE MONT BLANC OBSERVATORY.

By reason of the difficulty of reaching the Mont Blanc Observatory in winter, it became necessary, in order to obtain the registering of the principal phenomena of the summit, to construct an instrument that should run for a very long time (that is to say, during the winter and spring) without being wound up.

This is a problem that I asked Mr. Jules Richard to solve, and that led him to the construction of the remarkable instrument which I have just presented photographs of and which Mr. Richard has placed before the eyes of the Academy.

The entire instrument (Fig. 2) is actuated by a weight of 200 pounds descending from a height of about 20 feet in 8 months. This weight moves a pendulum that actuates and regulates the motion of the apparatus.

As a pendulum was required that should be affected as little as possible by the variations of temperature, Mr. Richard selected the escapement one of Denison, which he improved (Fig. 2, A).

The advantages of this escapement are, on the one hand, the permitting of the use of a very small quantity of oil, that may be even null when the surrounding atmosphere is entirely free from dust. Denison states, even, that it has been impossible to observe any variation in the amplitudes of the arc of the balance when the oil was frozen and had the consistency of tallow.

All the motions of the meteorograph are communicated to it by a horizontal shaft, which receives its motion from the pendulum, at the rate of one revolution in twenty-four hours and communicates it to the bobbins and the various parts of the registering apparatus.

These bobbins with a speed variable in each instrument unwind the paper upon which the pens of the registering apparatus are to write.

BAROMETRIC REGISTERING APPARATUS.

The apparatus that registers the variations in barometric pressure is seen in the center of the engraving (Fig. 2, B).

The motions of the needle are controlled by those of the mercury in the lower branch of a Guy-Lussac barometer with a very large reservoir. I have adhered to the use of mercury on account of its offering a great guarantee of exactitude.

THERMOMETER AND HYGROMETER.

For the registering of the temperature and humidity, we have been obliged to have recourse, for the former, to the Bourdon system of metallic reservoirs, and for the latter to the hair hygrometer of Saussure. The thermometric reservoir and the cable formed by the hairs are connected with their respective pens by long rods, so that these parts can be exposed to the action of the external atmosphere, while at the same time preserving the registering in the interior.

REGISTERING ANEMOMETER.

The registering of the velocity and direction of the wind is done upon the same paper. The following is the solution of the principle adopted by Mr. Richard: A cylinder carrying a certain number of spirally arranged cams receives its motion from a weather vane or a Robinson rotary apparatus, and acts by means of these cams upon the tails of an equal number of pens, which it lifts in succession and forces to write during the entire time of the cam's action. For the direction, the apparatus carries eight pens, representing the eight principal directions of the wind. For the velocity, the cylinder is provided with ten cams that act in succession upon ten pens. Each pen is engaged during a tenth of a revolution of the cylinder, which represents a six-mile travel of the wind. The velocity is therefore represented here by the greater or less length of the traces left by the pens. The perfection with which the entire apparatus is executed does credit to Mr. Richard, and I am sure of being the interpreter of his feelings in giving praise also to Messrs. Emile Honore and Henri Libeert, who had special charge of the execution of this fine instrument. Such is the entirely new apparatus that is to be mounted upon the summit of Mont Blanc. I do not conceal the fact, despite the minute precautions that have been taken, that we are still in the presence of the unknown. But the interest of the question of these long-running registering apparatus, which will render so many services at elevated stations in which it is impossible to remain, is so great in my eyes that I have not hesitated to begin the experiment at once, leaving to experience the care of instructing us as to the modifications that it will be well to introduce into them in order to secure a sure and entirely satisfactory operation. — J. Janssen, in La Nature.

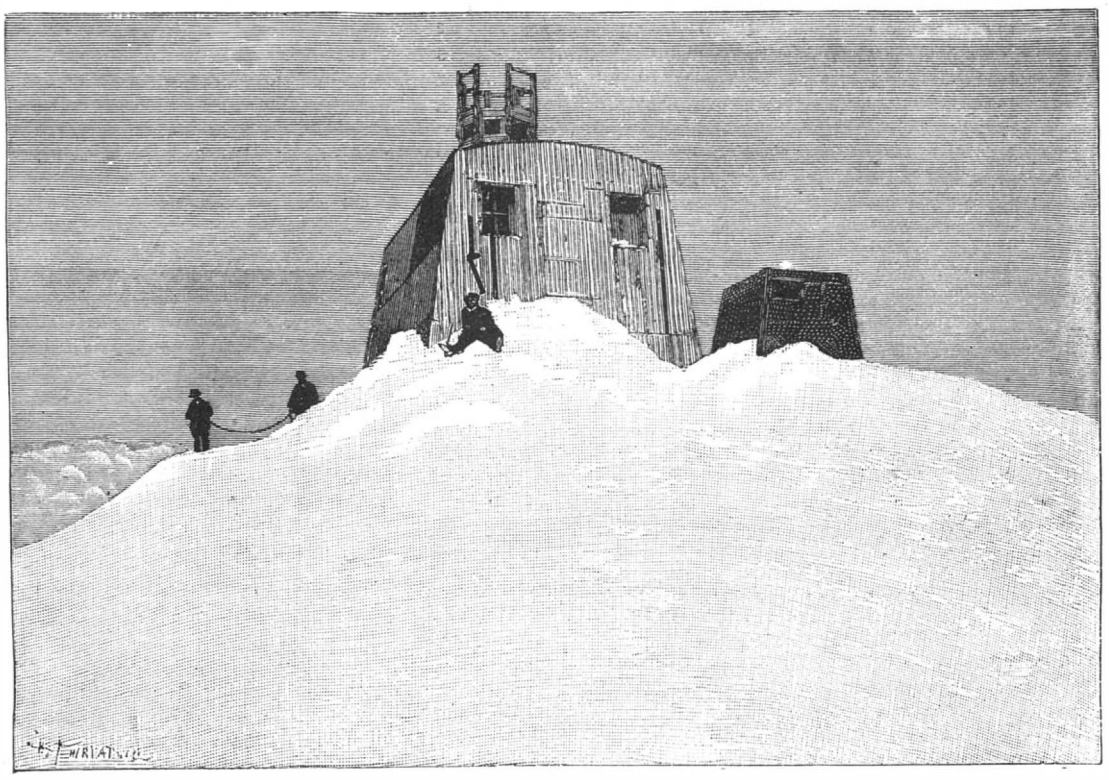

Fig. 1.—VIEW OF MONT BLANC OBSERVATORY AT THE BEGINNING OF THE YEAR 1894.

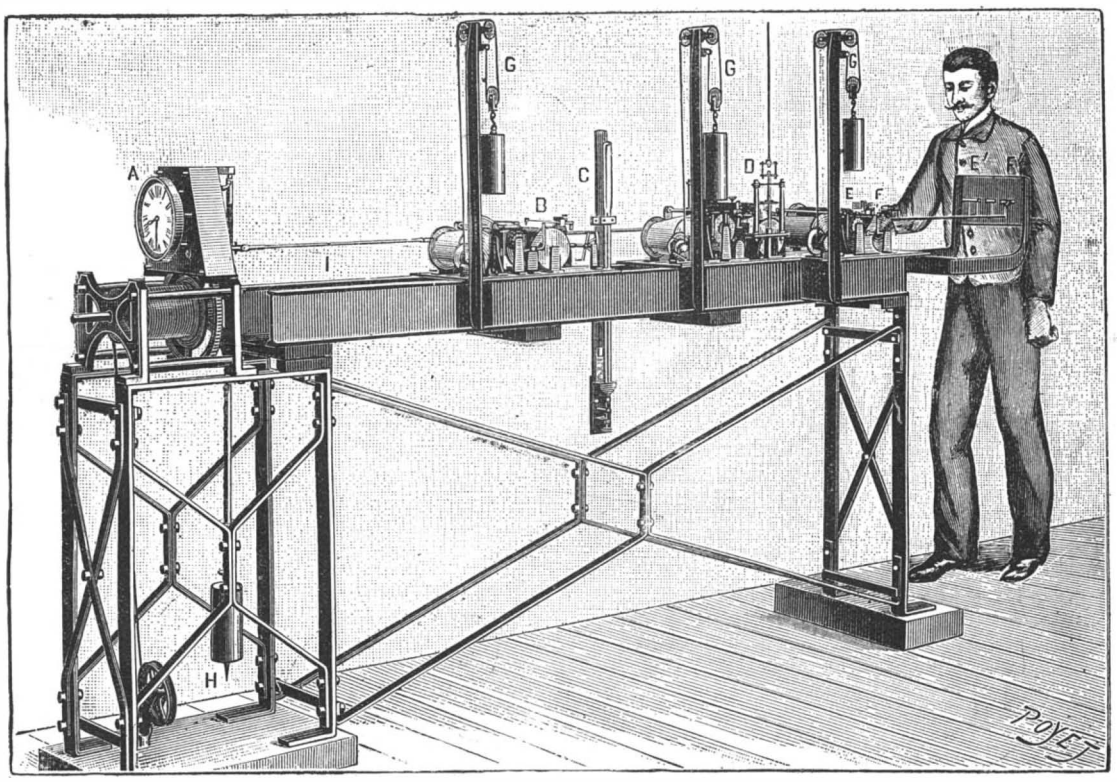

Fig. 2.—LONG-RUNNING METEOROGRAPH.

A. Clockwork running eight months. B. Registering system of the barometer. C. Barometer. D. Anemometer. E. Pen of the thermometer. F. Pen of the hygrometer. E′. Reservoir of the thermometer. F′. Hairs of the hygrometer. G G G. Motive counterpoises. H. Pendulum. I. Transmission of motion of the clock to the different registering apparatus.

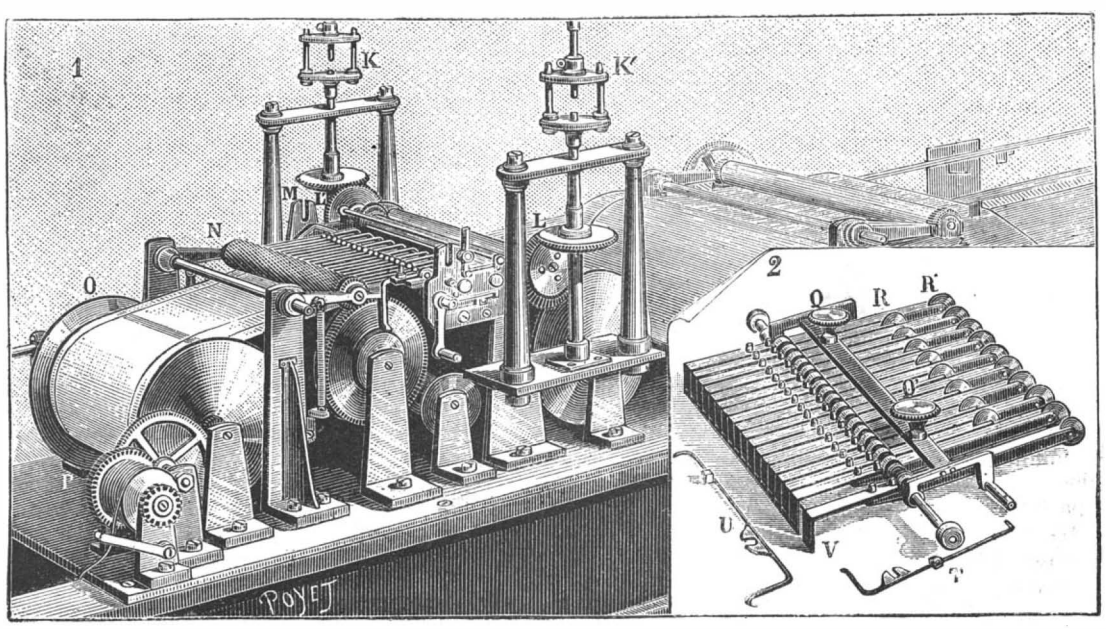

Fig. 3.—DETAILS OF THE METEOROGRAPH.

No. 1.—K K. Gearings of the weather vane and anemometer rods with the registering apparatus. L. Cam roller for velocity of the wind. L′. Cam roller for direction of the wind. M. Group of inscribing needles. N. Paper roller. O. Drum upon which the inscribed paper winds. P. Device for winding the paper after the registering. No. 2.—General view of the writing system. Q Q′. Buttons to allow of the removal of the needles. R R′. Wheels actuated by the cams, L and L′. T. Details of a tube pen of the anemoscope. U. Details of a tube pen of the anemometer. V. Series of tube pen carriers.

Protection of the Beet.

Many agronomists now recommend a very excellent method for the destruction of the May beetle and its larvæ, besides several other insects belonging to the same family. The Sylpha type makes its appearance on wheat fields that have followed beets in the rotation. The eggs have been deposited upon fermenting vegetable residuum left on the fields after harvesting. Many plans, says the Sugar Beet, have been adopted, such as sulphide of carbon combined with water and soap, arsenic preparations, etc.; none of them give entire satisfaction. The best of all modes consists in using strips of zinc placed on and slightly penetrating the ground in a slanting position. The joints between strips must be well looked after. The beetle cannot climb on the surface of the zinc, but continues along the border, to subsequently fall into ditches placed at regular intervals. In these a small quantity of sulphuric acid is placed, causing the immediate destruction of the beetles. The portions of the fields to be protected are those corresponding to the direction of adjoining fields, from which the army would make its march. Other preparations, such as tar, quicklime, etc., have all been tried. The tar soon acquires a hard surface, and the lime exposed to air will quickly become carbonated. The beetles would then find no hindrance to the destruction of a crop of beets found in their path.

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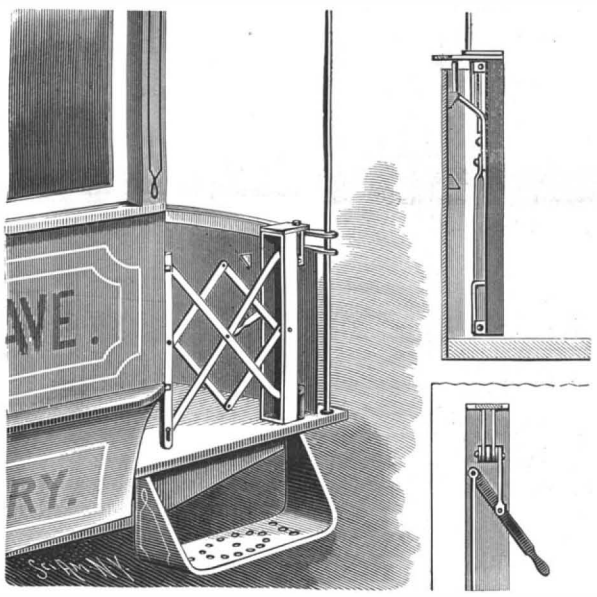
Manufacture of Plumbago.

Graphite crushed and passed through a sieve of from 120 to 150 meshes per inch is stirred into a saturated solution of alum or aluminum sulphate at 212° F.; steatite is then added, and more water if required. After mixing, excess of water is evaporated until a consistency suited to grinding in a chilled steel or other mixer is obtained. More graphite may here be added; then, after thorough grinding, the material may be compressed into cakes for household use, or is ready for the manufacture of pencils or crucibles. The average formula for the mixture is: Graphite, 80; steatite, soapstone, or talc, 14; alum, 6; but this varies with the purpose to which the material is to be applied. When several different kinds of graphite have to be employed, the richest in carbon is first mixed into the alum solution. By this process graphites previously regarded as incapable of being compacted are utilizable, and are improved in polishing power; for pencils, the material may be hard without being brittle, and black without being soft; while crucibles made from the treated graphite are at once harder, more durable, and lighter.—P. F. Johnson.

A PLATFORM GATE FOR CARS, ETC.

The gate shown in the illustration is of exceedingly simple construction, easily operated and readily locked in either open or closed position. It has been patented by Mr. Frederick W. Young, of No. 9 Hill Street, Bloomfield, N. J. It has a post-like partly open casing secured to the car platform and the dashboard at one side of the latter, and in the sides of this casing near the middle are pivoted two members of a set of lazy-tongs, the other members of the set being pivotally connected with the post forming the free end of the gate. This post is adapted to engage keepers on the car opposite the casing when the gate is closed, and in its upper and lower ends are vertical slots in which are pivoted the ends of another pair of lazy-tongs, whose opposite ends are connected by pivots with links having vertical movement in the casing, the links being pivotally connected with a handle lever, as shown in the small figures. The two sets of lazy-tongs



F. W. YOUNG'S SAFETY GATE.

are independent of each other, and by moving the handle lever up or down the gate is opened or closed, bevel catches on the inner face of the dashboard locking the lever in either the lower or upper position. The casing at the side of the dashboard is of such width as to accommodate all the members of the gate proper, so that no part of it projects when the gateway is open.

The New British Torpedo Boat Destroyers.

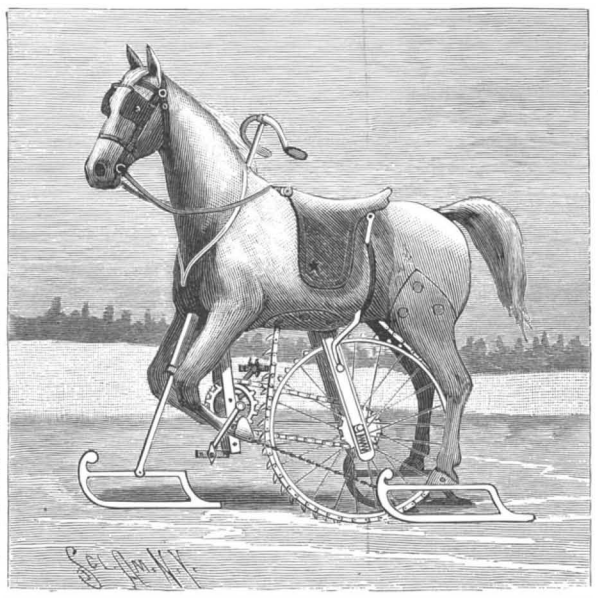
The torpedo boat destroyers Havock and Hornet, during the recent maneuvers, although they rolled about in an unmerciful manner to their crews, proved to be good sea boats. The Havock had to return to port for repairs, while the Hornet broke down altogether, and, had she been alone, would most probably have foundered. She had only just been asked to show the stuff she was made of by catching a torpedo boat when the cylinder cover cracked, two piston rods bent, and a large hole was knocked in her condenser. Both engines were placed hors de combat, and she was towed into port by the Speedy. In consequence of the defective working of the machinery of these catchers, it is reported that vessels of this type are in future only to be employed in couples.

Two more torpedo boat destroyers have taken the water, the Sturgeon, on July 21, from the shipbuilding yard of the Naval Construction Company, at Barrow-in-Furness, and the Rocket, on August 14, from the yard of Messrs. J. & G. Thomson, at Clydebank.

The Lynx and Decoy have made successful trial trips. The latter vessel, during six consecutive runs over the measured mile at the Maplins, attained a mean speed of 27·641 knots. During the three consecutive hours of full speed steaming the mean speed attained was 27·77 knots, or more than three-quarters of a knot over the contract. The Lynx had attained a maximum speed of 28·3 knots, when a joint of a small pipe broke, and the trials were postponed.

A VELOCIPEDE TO RUN ON SNOW AND ICE.

This machine, patented by Mr. Samuel Young, is preferably made in the form shown in the illustration,



SAMUEL YOUNG'S ICE VELOCIPEDE.

although its body may be constructed substantially like that of a safety bicycle. As shown, the front legs form hangers for the pedal shaft and the rear ones are detachable and each connected with a runner. The steering rod, with a handle bar on its upper end, passes through the front portion of the body, and its lower end is secured to a runner. In a recess of the body above the pedal shaft is a vertical U shaped hanger adjustably secured to the front legs by screws passed through one of a series of holes, whereby the height of the hanger is regulated, and the hanger supports the pedal shaft, mounted in suitable boxes. The driving chain from this shaft extends backward over a sprocket wheel, connected with a large sprocket wheel journaled in vertically moving slides which project up into the body of the machine, the large wheel carrying a spur chain adapted to contact with the snow or ice. The slide frames are carried by a slotted clip in the under side of the body, and the spur chain runs over a sprocket wheel on a shaft journaled in vertically adjustable boxes in the upper ends of the slides, the latter resting on springs which also support a portion of the saddle. Connected also with the slides are rods which extend upward on opposite sides of the body and terminate beneath the rear end of the saddle. Chains connect the rear runners with the front legs. Further information relative to this improvement may be obtained of Mr. Samuel Young or Mr. Michael A. Powers, Ontonagon, Mich.

Welding by Pressure.

According to Nature, M. W. Spring, who about fifteen years ago proved the possibility of welding metallic bodies by simple pressure at temperatures far below their fusing point, publishes an interesting extension of his researches in the Bulletin de l'Academie Royale de Belgique. He was led to the conclusion that at a certain temperature, where a metal is to all appearances a perfect solid, a certain proportion of the molecules attain a rate of vibration corresponding to the liquid state, and that these molecules, by softening the body, make it capable of welding and of producing alloys with other metals. The metals were put in the shape of cylinders bounded by plane surfaces, upon the purity of which great care was bestowed. They were then mounted in a stirrup, and pressed together by means of a hand screw. In this state they were placed in a heating oven, and kept at a constant temperature between 200° and 400° for from three to twelve hours.

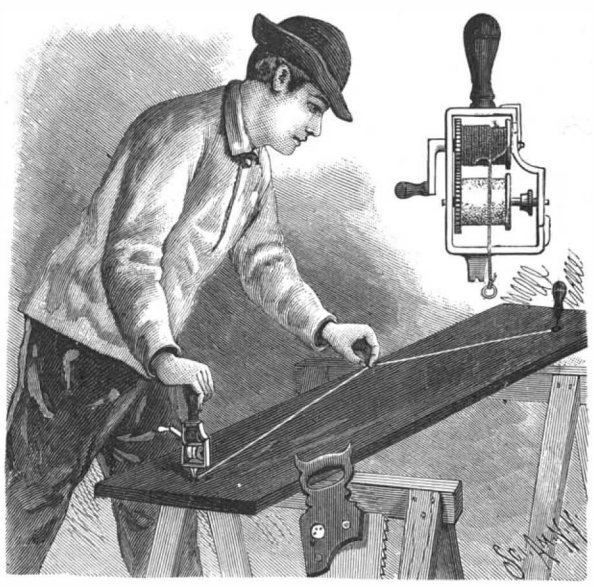
The most perfect joints were produced with gold, lead, and tin, and the worst with bismuth and antimony. Two cylinders thus welded together could be put in a lathe, one of them only being held in the chuck, while the other was being worked upon by a cutting tool, without coming apart. They could be separated with the aid of pincers, but then a rough breakage was produced which did not coincide with the original plane of separation. It appears that the more crystalline the bodies are the less do they exhibit this phenomenon of incipient liquefaction, which begins to show in the case of platinum, for instance, at 1,600° below its fusing point. That such a liquefaction or softening actually takes place was proved by cutting a delicate spiral 0·2 mm. deep on the end surface of a piece of copper weighing 130 grammes, and placing it upon a sheet of mica. After keeping it at 400° for eight hours, the spiral had entirely disappeared, and the surface looked as if just fused before the blowpipe. Where two metals were employed, alloys were formed, which, in the case of lead and tin, were fusible and flowed out at 180°. By placing a perforated disk of mica between the two, the outflow could be prevented, but the alloy formed at the center and the metals were hollowed out in the proportion of their degrees of liquefaction. In a lead-antimony couple, the hole in the lead was 8 mm. or 9 mm., and that in the antimony 2 mm. The most striking and novel experiments, however, were those showing the evaporation of metals, or rather their sublimation, at temperatures between 300° and 400°. This was also shown by inserting a disk of mica say between a zinc and copper couple at 360°. When air was carefully kept away from the surfaces, the copper was tinted a golden yellow over the area of the hole in the mica, the exact color of tombac, and a brown layer was produced on the zinc, which chemical analysis proved to contain copper. Similar results were obtained with cadmium, the thickness of the mica being 0 8 mm.

Lighting of Trolley Cars.

A system of lighting tramcars by electricity has been devised by Mr. W. M. Miner, the electrical engineer of the American Manufacturing and Engineering Company, New York, and a demonstration of it was recently given as installed in a car in Hoboken, N. J. The visitors were conveyed in the car, and in running over the line the trolley circuit was frequently broken in order to show the value of this system in always keeping the car illuminated whether the trolley wheel is on or off. The system consists in the use of a small storage battery of six Donaldson-Macrae storage cells, which are used to light a duplicate set of lamps should the trolley come off or the motor current give out or be interrupted in any way, the battery being switched on automatically when the motor circuit is broken. A trolley current is passed through an electromagnet, which completes a circuit through incandescent lamps connected in series in the usual manner. The same current also passes through the storage battery, keeping it charged. If the trolley comes off, or the current gives out or is interrupted in any way, the armature of the magnet is drawn back against its backstop, closing the supplemental circuit from the storage battery through a switch to the armature of the magnet, backstop and lamps, returning to the storage battery, thereby insuring light in the car whenever lights are required, independent of the action of the trolley. When the main circuit is restored by replacing the trolley or otherwise, the current takes its original course through the main circuit lamps, energizing the magnet (drawing its armature away from the backstop), storage battery, and ground, recharging the storage battery and lighting the car as before, thus automatically insuring a constant light in the car under all circumstances.

A LINE CHALKER FOR CARPENTERS' USE.

This simple and inexpensive device, while serving as a holding reel for the cord, is also a line fastener or securer, to hold the line after it is chalked at any desired point from which the mark is to be made. It has been patented by Mr. John W. Neff, of Buckhannon, West Va. Journaled in a frame having a convenient handle, as best shown in the small view, are



NEFF'S LINE-CHALKING DEVICE.

a line reel and a chalk-holding shaft, geared to be operated together by means of a crank on the line reel shaft. The frame is preferably made in two sections, held together by screws, to facilitate placing and removing the shafts. The chalk-carrying shaft has one end threaded and fitted with an adjusting screw, which bears on a disk sliding on the shaft, to clamp a centrally apertured cylindrical piece of chalk thereon. A notched, spur-like projection from one end of the frame forms a convenient means for holding the line after being chalked to a fixed point.

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Treatment of Apoplexy.

Preston, of Baltimore, believes that in the treatment of apoplexy more might be done in the prodromal stage if this condition were more carefully studied and oftener recognized. There are no constant or certain prodromata, but in a considerable proportion of the cases here related the history obtained afterward from the patients showed the existence of headache, vertigo or a sense of fullness in the head, numbness of one side, etc. These symptoms in some instances existed for a week before the apoplectic attack. It is very important to heed these warnings, especially in cases where there is atheroma of the vessels, or where there is high arterial tension without atheroma. Rest, vascular sedatives, nitro-glycerin, large enemata, will often modify the force of the circulation and thus tend to avert the rupture of the artery. Some years ago the writer called to see an elderly woman, stout, with flushed face, headache, and unusually high arterial tension. While waiting for the family physician she was kept absolutely quiet, with ice to her head. While consulting in the next room, the patient, against orders, got up to use the commode; the arteries could stand no further strain, rupture occurred, and she died in half an hour, with all the symptoms of intracranial hemorrhage. Venesection would probably have averted this disaster. It rarely happens that the physician sees clearly enough to make use of bloodletting. After the rupture of the artery has taken place, it is doubtful whether venesection does any good. The most important part of the treatment of apoplexy is rest. There is no way by which the bleeding can be stopped, and it is probable that in the great majority of cases the increased intracranial pressure tends to control the hemorrhage. The ruptured artery or miliary aneurism is small, as a rule, and it is generally soon occluded by clot. If the amount of hemorrhage is moderate and not in a vital part of the brain, recovery, more or less complete, will take place if the clot remain in its first position.

Very often it happens that the original location of the clot was not specially dangerous, but from gravity or as the result of exertion the clot has forced its way through the soft brain tissue and done irreparable injury to more important structures. This can often be seen post mortem and the track of the clot made out. From this it follows that the greatest care should be exercised to prevent any more moving of the patient than is absolutely necessary. If it be possible, the patient should be laid down on a sofa or mattress in the room where the attack occurs and no attempt at movement made for twelve or twenty-four hours. It is better to slightly elevate the head by pillows, since this probably tends to modify the force of the heart's action in the cerebral vessels, and at the same time allows respiration to be carried on rather better than when the patient is perfectly flat. Opening the skull has been resorted to, but it is doubtful whether this is advisable, except in the case of meningeal or cortical hemorrhage. The ice cap to the head is of some use in allaying restlessness, and is extremely good treatment for the relatives and friends. In regard to drugs in this early stage there are practically no therapeutic indications that can be successfully met. The use of ergot and that class of remedies is of more than doubtful propriety. Aconite may sometimes be used to advantage in controlling a too forcible heart's action. As soon as the patient can swallow, it is the author's custom to administer a mixture of bromide and iodide of potassium, 30 to 40 grains of the former and 10 grains of the latter, and this is kept up for several days, then the bromide is omitted and the iodide used alone in increasing doses. In regard to the custom of administering croton oil or some drastic purge during the early stage, although sanctioned by almost immemorial usage, it is not only useless, but exposes the patient to the risk of making dangerous exertions, besides putting him in a filthy condition. The same objections in part apply to blistering and to the use of mustard. It is important to attend to the bladder and draw off the urine at regular intervals. The throat should be kept as free from mucus as possible and the surroundings of the patient rendered comfortable. These points have, perhaps, been dwelt upon with unnecessary minuteness, but one so often sees these cases handled in a mischievous manner. The physician, realizing the futility of any active treatment, is too apt to yield to any suggestion made by the family, and the object of this paper is to insist upon a simple and rational treatment of this condition.—Maryland Medical Journal.

Glycerin for Softening Leather.

Glycerin imparts considerable suppleness to leather, but soon sweats out in damp air. To fix it in the leather, it should first be incorporated with four times its weight of the buttery mass made by dissolving beef fat in warm cod oil. Another method of rendering the glycerin a permanent constituent of the leather is to incorporate it with a small proportion of white of egg. This mixture may be applied alone or may be followed by the above described glycerin oil. A solution of dextrin may be substituted for white of egg if this latter be too costly. By dissolving a tan stuff in glycerin and mixing it with cod oil and fat, a valuable stuffing for leather may be obtained.

Street Car Fenders Wanted.

By an ordinance of the authorities of Baltimore the street car companies are required to provide their cars with fenders. With this view a commission was formed, consisting of the mayor, city register, and city commissioner, for the purpose of considering the subject of life guards for trolley cars. Mr. Mendes Cohen, Past President Am. Soc. C. E., was employed to investigate and make a report on all fenders which came to his notice. In all, 70 different types were offered, but out of this number, which included nearly all, if not all, of the best known fenders, none met with his unqualified approval.

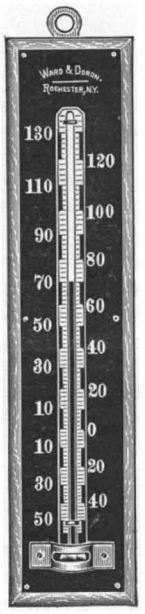
In concluding his report, Mr. Cohen says, in part:

What is needed is a very simple piece of work, the more simple the better.

It is required that the front surface of the car, striking a standing human being, shall be so arranged as to afford a reasonable prospect of saving the person from being dashed to the ground; and, further, so arranged that it shall do the least possible damage by its own impact; and, further, if it fails to do the duty expected of it, and the person does fall to the ground, or is already lying there, that it shall be so devised as to pass over him without causing further injury; and that there shall also be on each car a suitably arranged wheel guard, preferably of angular or "pilot" form, which shall be automatically brought in close contact with the street and rails, in order to prevent the crushing of the victim, whom the front device has failed to save.

EASILY READ THERMOMETERS.

The instrument shown in the illustration, styled by its manufacturers "a distance reading thermometer," is designed not only to be up to a good standard of accuracy for all ordinary requirements, but it presents the special advantage of being easily read at a distance of ten to fifteen feet in the small styles, and at proportionately greater distances in the larger sizes. As large figures are used, they are placed alternately on opposite sides of the scale, which is divided into alternate light and dark spaces by sections of ten degrees, the limit of each section being thus distinctly seen in such manner as to show at a glance the indicated temperature. The tube is filled with red spirits, guaranteed to be non-fading, and the liquid presents to view a wide surface. The makers of these instruments, Messrs. Ward & Doron, of Rochester, N. Y., have had forty years' experience in the manufacture of thermometers.



The Influence of Sugar and Tobacco on Muscular Effort.

In 1892 an important series of experiments was undertaken by Dr. Warren Lombard upon the influence of tobacco on muscular effort. The same subject has been investigated by Dr. Vaughan Harley, and the results of his observations are recorded in the first part of the Journal of Physiology for the present year. Dr. Vaughan Harley agrees with Dr. Lombard in considering that the amount of work done by the same set of muscles at different times of the day undergoes periodical variation; so we may accept as a fact that there is a diurnal rise and fall in the power of doing voluntary muscular work, in the same way as there is a diurnal rise and fall in bodily temperature and pulse. It is remarkable, however, that instead of the greatest amount of work being done, as might have been expected, on rising in the morning after a night's rest, it is found that at 9 A. M. the smallest amount of work is accomplished, the powers of doing muscular work in Dr. Harley's case increasing each hour up to 11 A. M. Immediately after lunch there is a marked rise, followed an hour later by a fall; while again an hour later, or about 3 P. M., the amount of work accomplished reaches its maximum. Then, from some unexplained cause, there is a notable fall at 4 P. M., which is succeeded by a rise at 5 P. M., after which a progressive fall takes place during each successive hour until dinner. Even during a prolonged fast more work was capable of being executed from 11:30 A. M. to 4:30 P. M. than at 9 A. M. Dr. Harley admits, however, that further experiments are required to determine this point satisfactorily. It was found in his experiments on the muscles of the middle finger that, in corroboration of a well-known physiological fact, regular exercise caused increase in the size of the muscles brought into play, and at the same time up to a certain point rendered them capable of performing more work. Sugar, taken internally, proved to be a muscular food; since, when taken on an empty stomach, there was on that day an increase of 25·6 per cent in the work done by the left middle finger, while the right middle finger showed an increase of no less than 32·6 per cent. Dr. Harley varied the experiment of administering sugar in many different ways, but always with the same result; the vigor of the muscles was always augmented. The influence of tobacco was not so marked in Dr. Harley's experiments as in those of Dr. Lombard. Dr. Harley considers that moderate smoking, in one accustomed to it, neither increases the amount of work nor retards the approach of fatigue. It perhaps slightly diminishes muscular power and hastens the onset of fatigue. Dr. Lombard holds that the use of tobacco has a powerful influence in this direction. Such experiments as these, even when no absolutely definite result is arrived at, are of importance, and if carried out with due precaution against error, in a large number of men, would undoubtedly constitute the most satisfactory basis on which a sound system of training should be carried out.—Lancet.

Mouth Breathing.

The mouth is the entrance to the digestive rather than to the respiratory organs.

Mouth breathing is neither natural nor healthful, but nature has so provided, that when, through diseased conditions, the nasal passages are occluded, we may obtain air through the mouth.

The nose, however, is the entrance to the respiratory tract.

Within the cavity of the nose are scroll-like bones, covered with mucous membrane, which greatly increase the surface of exposure in order to furnish the three special functions of heating, moistening and filtering the inspired air. The fact that mouth breathing is injurious is not sufficiently known. The air rushes into the lungs in such volume that its temperature is not regulated, its force is not controlled, it is in no way purified, and can thus easily give rise to diseased conditions of many kinds.

The winter season is the most prolific in the production of these resulting maladies, because of the difference in temperature of the external air and the body; and among the diseases liable to arise are pneumonia, bronchitis, laryngitis, croup, etc.; whereas the same air taken normally through the nose, being prepared for its reception into the delicate lungs, simply fulfills the natural law, and no harm results.

The habit of mouth breathing generally arises from some obstruction in the respiratory tract, but may be prevented in most cases by timely care. Parents realize too little the importance of nose breathing. In the minor ailments of children, when the nose may be slightly obstructed for a time, it can still, by persistent effort, give full respiration; but because it is easier, the child breathes through its mouth and acquires more or less of the habit.

If there is obstruction at any time, it is particularly liable to occur at night, showing itself by restless sleep, heavy breathing, and a cross child in the morning. It is quite safe to say that when a child persistently breathes through his mouth there is something radically wrong. There are several forms of obstruction to free nasal respiration — thickening of the mucous membrane within the nasal chamber, due to repeated colds; the presence, between the nose and throat, of glandular tissue, normal in character but unnaturally developed; enlargements of the tonsils and glands of the neck.

Each of these conditions may be remedied by skillful treatment, and a child who has been restless and snoring may be made to sleep quietly and restfully.

Persistent attempts to breathe through the nose will often be rewarded by success, and prevent the development of the disease commonly called catarrh.

Catarrh itself is not a disease, but a symptom of some obstruction or irregularity within the respiratory tract. It is much easier prevented than cured, while both are possible.

Keep your mouth closed and breathe through your nose.—C. Gurnee Fellows, M.D., in the Northwestern Sanitarian.

Weather and the Mind.

The psychology of the weather is suggested by Dr. T. D. Crothers as a promising subject for study. He says, in Science: "Very few persons recognize the sources of error that come directly from atmospheric conditions on experimenters and observers and others. In my own case I have been amazed at the faulty deductions and misconceptions which were made in damp, foggy weather, or on days in which the air was charged with electricity and thunder storms were impending. What seemed clear to me at these times appeared later to be filled with error. An actuary in a large insurance company is obliged to stop work at such times, finding that he makes so many mistakes which he is only conscious of later that his work is useless. In a large factory from ten to twenty per cent less work is brought out on damp days and days of threatening storm. The superintendent, in receiving orders to be delivered at a certain time, takes this factor into calculation."

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Correspondence.

An Induction Coil Phenomenon—Why does it Occur?

To the Editor of the SCIENTIFIC AMERICAN:

By holding a broken lamp to one of the secondary terminals of an induction coil, the glow can be increased by touching one of the primary terminals with the other hand. If the lamp is made to touch a primary terminal, it can be made to glow just as strongly as before, by touching a secondary coil terminal with the other hand. H. S. BURROUGHS.

Brooklyn, N. Y.

The Science of Rubbing.

No method of treating the various aches and pains to which the flesh is heir is more agreeable to the sufferer, or oftener effective, than a course of intelligent rubbing or massage.

We may believe that the benefits derived are due to the personal electricity which is imparted from the body of the one who performs the rubbing, or we may say that a counter irritation of the superficial parts is set up by the friction. There are those who assert that it is the activity into which the parts in question are urged by the process that is of benefit. The last explanation is probably the most nearly correct.

But, however we may explain the fact, it is certain that even unskilled manipulation may be productive of relief and comfort to a wonderful degree; while if the manipulator is acquainted with the anatomy of the human body, his touch may seem at times almost magical in dispersing pain.

By tracing out an inflamed nerve it is possible for masseurs—as professional rubbers are called—to reduce the most troublesome of neuralgias, even to the extent of relieving the ever-dreaded and long-lingering sciatica. Muscles which refuse to contract, and joints which for a long time have been stiff, may be brought into renewed activity.

Of course, it is not possible for every one to show the skill of a trained masseur; but any of us can do much in an humble way toward relieving the sufferings of those who are dear to us.

We should always be careful to assist the flow of the blood in its course through the painful parts, as this fluid bears with it both food and strength. Whether a muscle, which is very often the seat of the pain, is tired and sore from overuse, or cramped and stiff from non-use, the soothing action of a fresh supply of blood is equally acceptable.

Nerves require more delicate handling, as they are often exquisitely sensitive to the slightest touch; but patient persistence and care are certain to be productive of greater or less relief.

It is not necessary in every instance to exercise so much delicacy, however, as there are many conditions which are more rapidly benefited by the vigorous use of a crash towel till the superficial parts over the seat of the trouble are aglow.

Circular motions, pinching, and slapping, all enter into the methods of a successful masseur.

Finally, the success of the treatment of pain by rubbing is to be found, not so much in the brute force exhibited in the manipulations, as in the gentle, educated touch which is able to recognize at once the requirements of the individual case.—The Youths' Companion.

New Candelabra for St. Paul's.

An interesting addition has just been made to the furniture of St. Paul's Cathedral, London, in the shape of two colossal bronze candelabra, copies of famous originals at Ghent. A curious history attaches to them. Cardinal Wolsey, when in the heyday of his power, set about preparing a sumptuous tomb for himself in the Wolsey (now the Albert) Chapel at St. George's, Windsor. Before it was completed his fall came. The sarcophagus—of black marble—intended for the cardinal ultimately became the resting place of Nelson in the crypt of St. Paul's. The four giant candelabra by Torregiano, designed for the corners of Wolsey's sepulcher, were presented by Henry VIII. to old St. Paul's. Being covered with gold leaf, they were valuable, and a century later they were sold by Cromwell to the authorities of Ghent Cathedral, where they have remained ever since.—N. Y. Evening Post.

Long Distance House Moving.

A curious case of house moving was recently witnessed in Oregon: A man who owned a residence at Seattle, which cost him $5,000 to erect, removed to Olympia and did not have sufficient funds to build another house. He bought a lot and concluded to remove the building he owned at Seattle. Every one laughed at him, but he persisted. Rolling the house down to the river, he loaded it upon a scow and it was soon at Olympia, a distance of about 60 miles. Then he had it rolled upon his lot and, strange to say, not a timber was strained nor even a piece of furniture broken, although he had not removed the contents before starting the house upon its unusual journey.

Margarin Compared with Butter.

BY A. JOLLES, MONATSCH. CHEM.

Various statements have been made as to the relative values of margarin and genuine butter as foodstuffs, the general outcome of which is that while there is not much to choose between the two as regards digestibility and nutritive value, butter has a slight advantage over margarin in these respects. The author has carried out a long series of observations with a dog fed during four consecutive periods with butter and margarin alternately; the urine and fæces being collected and examined for fatty matter, nitrogenous constituents, etc., so as to obtain the data for determining how much fatty matter passed unassimilated through the animal under each set of conditions as to feeding. In the first and second periods more fat and less carbohydrates were given; in the third and fourth, less fatty matter and more carbohydrates; the fatty matters being butter in periods 1 and 3 and pure margarin in periods 2 and 4. The various articles of food (wheatmeal, sugar, etc.) were carefully analyzed and made up into dog biscuits, so that the amounts of the different kinds of food constituents consumed during each period were accurately known. In this way it was possible to trace out during each period the proportion of proteids, fat, non-nitrogenous matters (starch, etc.), and mineral constituents (ash), which were either digested and assimilated or passed out undigested in the fæces. So far as fatty matters were concerned, 97 to 98 per cent was uniformly digested, whether butter or margarin; the figures obtained during the four periods respectively were as follows (in grammes):

	Period.			
	I.	II.	III.	IV.
Contained in food	52·12	42·14	36·84	37·36
Contained in fæces	0·79	0·86	1·05	1·22
Digested	51·33	41·28	35·79	36·14
Percentage digested	98·4	97·9	97·1	97·3

Hence the conclusion is drawn that under similar conditions of feeding, butter and margarin have practically identical coefficients of digestibility and nutritive value.

The Blackwall Tunnel, London.

A paper on this great work was read before the British Association by Mr. Maurice Fitzmaurice. He commenced with some interesting details of works of a similar nature which have been constructed in different parts of the world, and went on to say that the tunnel under the Thames at Blackwall, which is being built for the London County Council, under the direction of their chief engineer, Mr. A. R. Binnie, has now been under construction for more than two years. In 1891 Messrs. Pearson & Son's tender for the construction of the Blackwall tunnel, amounting to £871,000, was accepted by the London County Council, and the work was commenced in 1892. Mr. D. Hay and the author were appointed as resident engineers under Mr. A. R. Binnie, and Mr. E. W. Moir took charge of the works for the contractors. The Blackwall tunnel is much larger than any tunnel yet constructed by the methods adopted. The outside diameter of the St. Clair tunnel, which is the largest one at present, is 21 feet, while that at Blackwall is 27 feet in external diameter.

The following leading dimensions were quoted by the author: Length from entrance to entrance, 6,200 feet. This total distance is divided as follows: Open approaches, flanked by retaining walls, 1,735 feet; cut and cover portion, built of brick and concrete, 1,382 feet; cast iron lined portion, 3,083 feet. The width of roadway is 16 feet and the width of each footpath 3 feet 1½ inches. The tunnel is level under the river, and the gradient on the north side is 1 in 34 and on the south side 1 in 36. There are four vertical shafts, two on each side of the river, and varying in depth from 75 feet to 100 feet below ground level. Each shaft is a wrought iron caisson of 58 feet external diameter at the bottom and 48 feet internal diameter throughout, and lined with brickwork. Each caisson consists of two wrought iron skins, 5 feet apart, braced together, and terminating in a cutting edge. Two circular holes, which are temporarily plugged while sinking, are left in each caisson to give way for the tunnel through the shaft, and provision is made for an air-tight floor above the level of the tunnel when necessary. The space between the two skins is filled with concrete. Two caissons are in place, and the two others are in course of being sunk. The tunnel is constructed of cast iron rings 2 feet 6 inches long, and each ring consists of 14 segments and a key piece. The thickness of metal is 2 inches, and each segment has flanges 12 inches deep, and both longitudinal and circumferential joints are planed.

The shield used for the construction of the tunnel is 19 feet 6 inches long, and is 27 feet 8 inches in external diameter. The outer shell consists of four ⅝ inch steel plates. The shield is divided into a front and back portion by two vertical diaphragms at right angles to its axis. It is thus possible, when necessary, to have a higher air pressure in the working face of the shield than in the completed portion of the tunnel. The space between these two diaphragms forms an air lock, both diaphragms, of course, being provided with doors, by which access to the working face is obtained. At the back of this air lock the shield consists only of the outer shell, which always laps over and outside at least one completed ring of the tunnel, and inside of which all the rings are built. The space of 4 inches left outside the rings when the shield is shoved forward is filled with grout, forced in by air pressure through screwed holes made in each segment for the purpose. Everything is quite solid at the back of the cast iron lining. At the air lock and in front of it there is an inner shell, connected stiffly to the outer shell by circular girders and in other ways, and both joining together at the cutting edge. The working face is divided into four horizontal floors and 12 working chambers by vertical and horizontal diaphragms in the line of the axis of the shield. A hanging iron screen in each compartment about 6 feet back from the cutting edge forms a safety chamber at its back, where men could stand with their heads above water in case of a rush of water in the face due to air blowing out suddenly or from other causes. Provision is made for using iron poling boards at the face, shoved forward by jacks, when in ballast, if necessary. The shield, which weighs about 250 tons, is shoved forward by 28 hydraulic jacks fixed at the back and butting against the cast iron lining, and able to exert a total pressure of over 3,000 tons.

The Passing of Red Brick.

In no department of human industry, says the Washington Post, has there been greater evolution of late years than in the business of making bricks. Formerly we had nothing but old fashioned red brick that reached its climax of perfection at Philadelphia, and was shipped thence at great expense all over the country where a high grade article was in demand. But the red brick has had its day for architectural use, and in its place has come to stay the brick of lighter hue—pink, buff, yellow, and, in fact, of nearly every shade.

A brick can be made that is as mottled as a sea gull's egg, or one that will show the varying tints of an autumn leaf. It is done by adding certain metallic ingredients to the clay after the latter has been ground to the finest powder. It is the iron in the clay that gives the ordinary brick its deep red. In future most of our city residences are going to be constructed from brick of these pleasing colors. They give relief to the eye and variety. What can be more monstrous than a row of red brick houses? Washington is taking to the new style, and in this clear atmosphere, unspoiled by the soot from soft coal combustion, a house of this beautiful material will stand fresh for a century and be solid years after one made of granite had disintegrated.

Mines of Wood.

A curious source of wealth is reported by the French consul at Mongtze, in upper Tonquin. It lies in wood mines. The wood originally was a pine forest, which the earth swallowed in some cataclysm. Some of the trees are a yard in diameter. They lie in a slanting direction, and in sandy soils which cover them to a depth of about eight yards. As the top branches are well preserved, it is thought the geological convulsion which buried them cannot be of great antiquity. The wood furnished by these timber mines is imperishable, and the Chinese gladly buy it for coffins. Along the coast regions of some parts of New Jersey there are trunks of cypress trees, deeply buried in the sand, the recovery of which forms a valuable industry, the timber being used for making shingles.

Simple Process for Bronzing Copper.

Mr. Mondit, of Caen, publishes a formula which is said to be capable of giving every tone from bronze to antique green, according to the length of time that the copper is allowed to remain in contact with the liquid. After the piece has been scoured, it is covered with the following mixture by means of a brush:

	Parts.
Castor oil	20
Alcohol	80
Soft soap	40
Water	40

The mixture is left on till the required shade is obtained, then dried with hot sawdust and coated with a very dilute varnish.

A Blue Ink for Use on Glass.

A blue fluid for writing on glass, which is not attacked by water, can be made, according to Neueste Erfindungen und Erfarhungen, as follows: Shellac, bleached, 10 parts; Venice turpentine, 5 parts; oil of turpentine, 15 parts; indigo, in powder, 5 parts. Mix the shellac, turpentine, and oil of turpentine, and place in a waterbath, under gentle heat, until solution takes place, and then stir in the indigo.

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MULTIPHOTOGRAPHY.

A very pretty system of photography, enabling us to see ourselves as others see us, and affording opportunity for much range in the art of posing, is the multiphotograph. If an image is placed in front of two mirrors inclined to each other at an angle of 90°, three images will be produced in the mirror; at 60°, five images will be produced; and at 45°, seven images; and if the mirrors are parallel, theoretically an infinite number of images will result.

In the process of photography which we illustrate advantage is taken of this to produce at one exposure a number of different views of the same subject. The person to be photographed sits with the back to the instrument, while in front of the face are two mirrors, set at the desired angle to each other, their inner edges touching. In the case illustrated these mirrors are inclined at an angle of 72°. Four images are produced. The exposure is made and on the developed negative appear not only the back view of the subject, but also the four reflected images in profile and different three-quarter positions. The courses taken by the rays of light are determined by the law that the angle of incidence is equal to the angle of reflection. In the diagram we have traced the rays of light on their course from subject to mirror and back to the camera, giving a good idea of the relation of the images to the subject and of the five images to the focal plane, the virtual position of the images being further from the instrument than is the subject proper.

REPRODUCTION OF A MULTIPHOTOGRAPH.

The gallery equipment for this class of work is shown in one of the views, while the appearance presented by a full length figure with the aid of the mirrors is shown in another cut. A very interesting illustration of what can be done by this process is presented by the reproduction of a photograph actually taken, where the interesting expression and marked characteristics of the face serve to bring into strong prominence the utility of this process for representing the human face.

It is obvious that simple as the process and idea appear, it might have many uses in the study of other forms of nature.

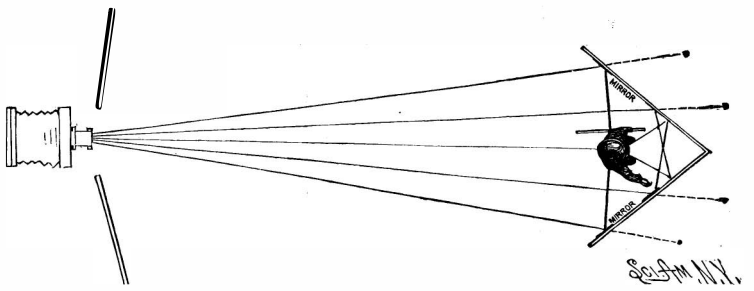


DIAGRAM OF THE PRODUCTION OF FIVE VIEWS OF ONE SUBJECT BY MULTIPHOTOGRAPHY.

Peanut Oil.

The report of the American consul at Marseilles contains some facts concerning the manufacture of peanut oil, which is largely coming into use for various economic purposes. Extraction of oil from peanuts is rapidly increasing, no fewer than seventeen factories being at present engaged in the industry, and the quantity of nuts imported at Marseilles for this purpose during 1893 exceeding by 314,000 metric quintals (69,224,400 pounds) the importation for 1892.

The general method of producing the oil is as follows: On arriving at the factory the peanuts are first placed in a machine of the nature of a "winnower," in which all outside dirt and other foreign substances are removed. Having been thus superficially cleansed, the nuts are conveyed by an Archimedean screw to the shelling machine, where they are deprived of the shells. Thence the nuts fall into the first triturating machine, consisting of a pair of cast iron rollers, where they are coarsely ground, and at the same time any foreign bodies, stones, etc., are by an ingenious arrangement rejected. From this machine the meal passes to another, where it is again ground finer, and thence into a long hexagonal case forming a sieve, through which the fine meal passes, while the coarse is sent back to the rollers again. The meal is then pressed in "scourtins" made of horse hair, a pressure of 2,850 pounds to the square inch being exerted and left on for an hour, which is sufficient to extract all that can be obtained in the first yield. The meal is then removed from the "scourtins," ground a second time, heated to a temperature of about 70° C. (158° F.), and a second pressing is effected. If oil of a very fine quality is required, the nuts are crushed only once, partially ground nuts yielding a smaller but finer product. The yield varies according to the quality of the nuts. Mozambique nuts produce about 50 per cent in the first pressing, and the value is from 70 f. to 95 f. per 100 kilos.; the second pressing yields about 12 per cent, the value of which is from 45 f. to 50 f. per 100 kilos.

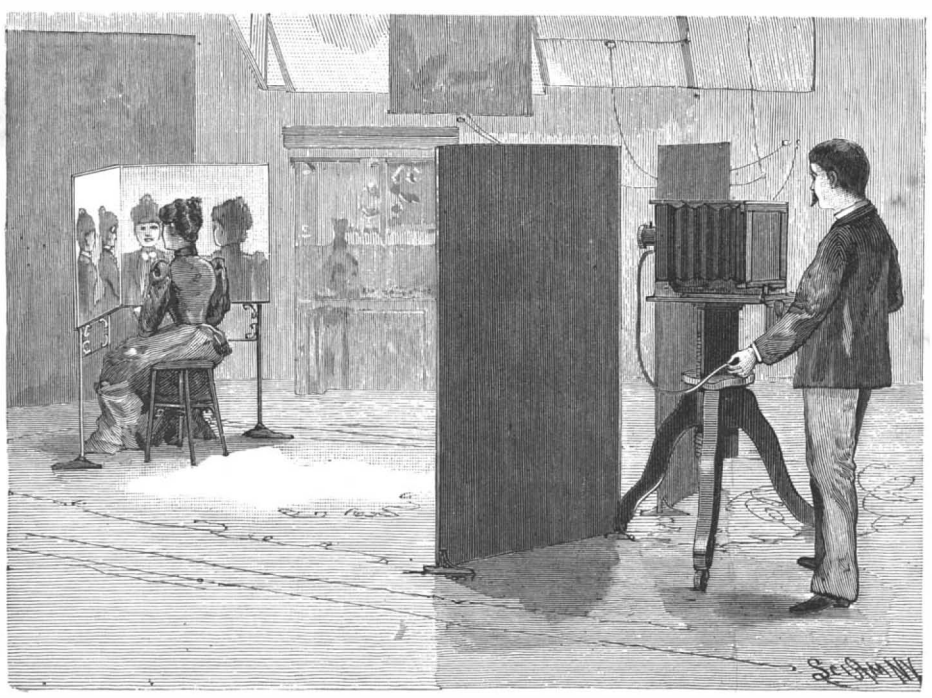
The oil is largely devoted to the manufacture of white soap, for which it is highly prized. It is also used as salad oil and in the composition of margarin. Large quantities are also sold as olive oil, principally in the United States. A smaller amount is used for illuminating purposes.

The cake left after pressing is particularly rich in nitrogen and forms an excellent cattle food, and commands a price of 13 f. per 100 kilos., if made from shelled nuts.

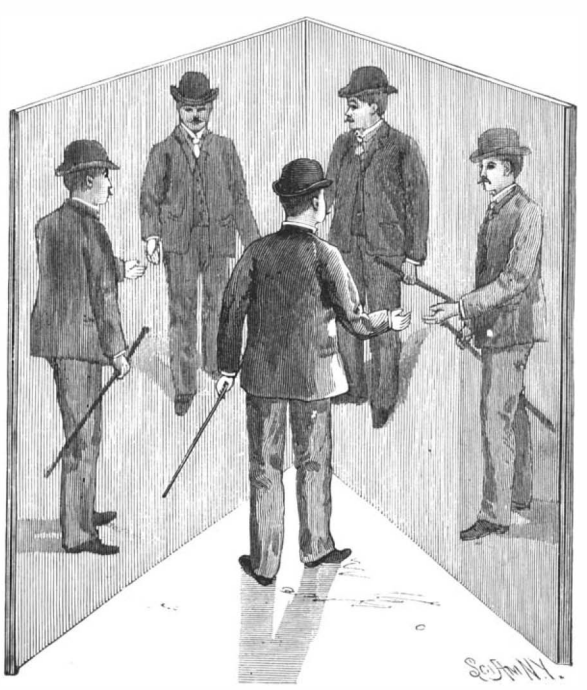
Meadow Lake.

Meadow Lake, which has such a wonderful history, is situated about eleven miles north of Cisco, Cal. There still remain portions of the old wagon road which was hewn out of the rock during those palmy days. At one time it was traversed by scores of freight wagons, and several trips daily were made with eight horse fourteen passenger stage coaches. The manager of the Colfax Sentinel recently made a trip on horseback. The old stage road was crossed again and again by the trail. In some places trees many inches in diameter have grown in the very center of the road. For the greater part of the distance the road is still in good condition, though in many places the stone walls have given away. At best the trip by stage to Meadow Lake must have been a wild one. At one time Meadow Lake had a population of 5,000. During many years subsequently Old Man Hartley, the hermit, was the sole inhabitant. Hartley's death occurred, however, about two years ago. A more picturesque spot than the site of this once world-famed mining town would be difficult to find, while the lake itself is enchantingly beautiful. The lake is about a half mile in width and extends along the depression of this mountain meadow a distance of nearly four miles. Surrounding the lake is a tract of level land comprising 40 or 50 acres, and the whole is almost completely inclosed by rugged peaks. A score of buildings are all that mark this once busy city. The others have succumbed to the ravages of fire or been crushed by the heavy snows of this region Here at one time could be found fine churches, theaters, and dance houses, school houses, saloons, bakeries, breweries, banking houses, hotels, and a daily newspaper, and a mining stock board in daily session. The ruins of one stone building may still be seen. It was built by Perkins & Smith, of Brady City, Sierra County, at a cost of $32,000. Many persons who have never visited the camp will remember it distinctly from the fact of the regular assessments which they paid on mines located in the camp for them.

Some persons who have never visited the camp are hasty in saying that the gold is not in the quartz. After visiting a half dozen ledges and prospecting the ore, the writer did not find a ledge that showed less than twenty colors to the pan. He even took a horn of the tailings that passed from the plates at the old California mine (formerly the property of Ralston) and secured from it more than a score of colors.



GALLERY ARRANGED FOR MULTIPHOTOGRAPHY.



IMAGES OF A FULL-LENGTH FIGURE.

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MR. MAXIM'S FLYING MACHINE.

BY PROF. C. V. RILEY.

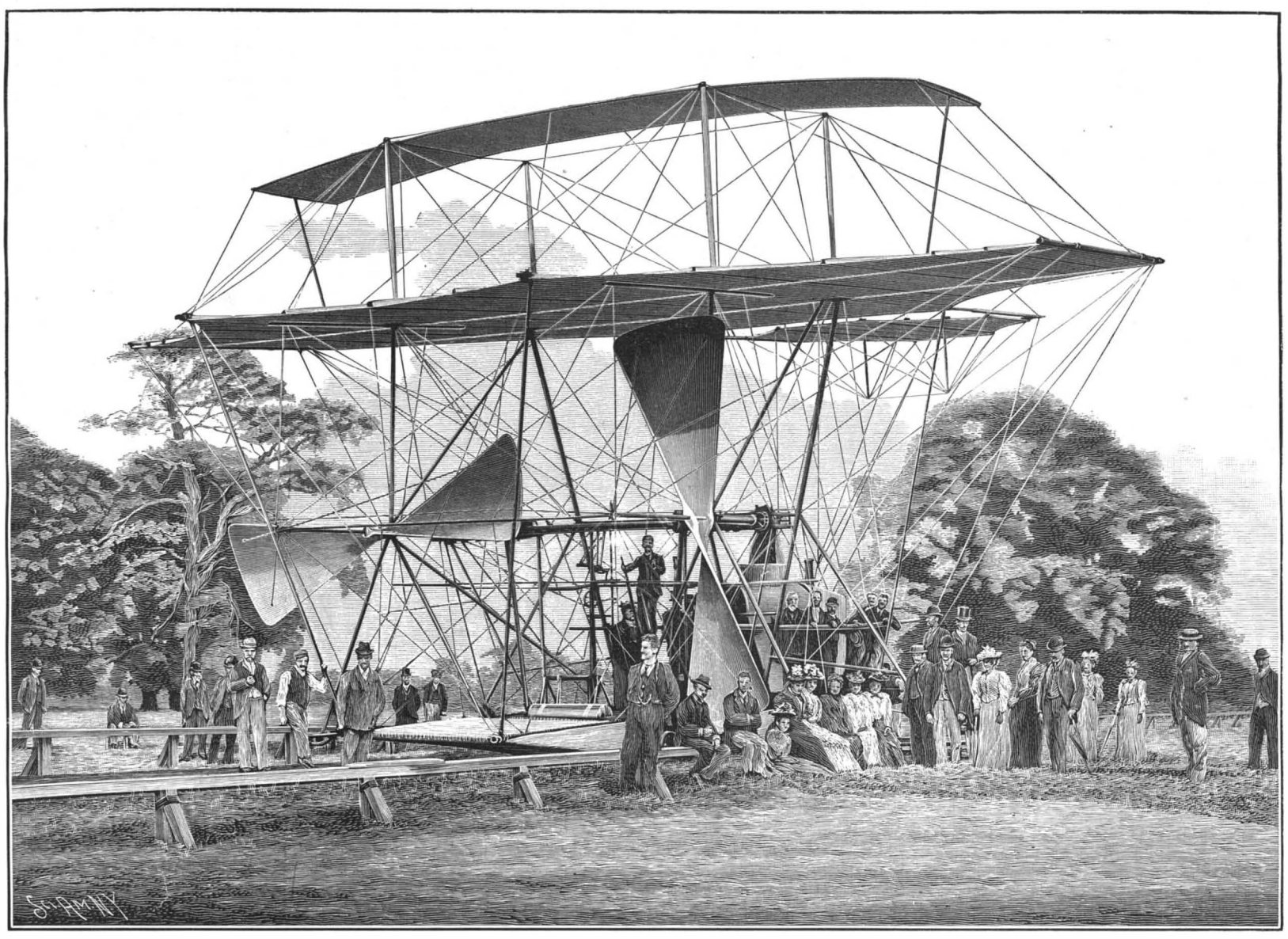
Upon my return recently from the meeting of the British Association, at Oxford, I gladly availed myself of a kind invitation to visit Mr. Hiram S. Maxim, at Baldwyn's Park, Bexley, Kent, where for the past four years he has been experimenting with and perfecting what is usually called the Maxim flying machine, but were more correctly termed a soaring machine. Accounts of the experiments have been published from time to time, but the most complete and authoritative is contained in a paper recently read by Mr. Maxim himself at the above-stated meeting in Oxford.. I send you a manuscript copy of this, which he has furnished at my request,* and a photograph showing the machine as it appeared immediately after the famous experiment of July 31 last.

This paper renders it quite unnecessary that I should give any descriptive details; but no one who has not inspected the various parts of this huge soaring mechanism can fully appreciate the marvelous ingenuity and the truly scientific method brought to bear in elaborating the various details, which provoke admiration the more one studies them. The engine, the boiler, the numerous automatic devices for feeding and regulating the fire, the screws, the aëroplanes, the rechine broke away, first by bending and breaking the rear axle and then by the forward retaining wheel on the underside of the left retaining guide breaking away. Being thus lifted away from the guides at three points, the momentum broke the heavy retaining timbers to the right, some of which became entangled in the framework (the engine being already stopped), and the machine embedded its wheels in the ground.

The lateral brasure made by the left forward wheel in breaking from the retaining wooden guide gives one a graphie idea of the power exerted, while the fact that the machine fell outside the guide to the right, without in any way affecting the iron traction rails within, is the best evidence that the machine was lifted from the ground just as described by Mr. Maxim. Hence, notwithstanding the accident, the machine was made to soar above the ground, and this was the first time in the history of the world that this feat was accomplished in the same way. The meaning of this accomplishment can best be appreciated by remembering that the machine, with water, fuel, and three men, weighed nearly 8,000 lb.; that the screws were 17 feet 10 inches long and 5 feet 2 inches wide, and that the area covered by the aeroplanes was some 4,000 square feet.

Mr. Maxim has thus demonstrated his ability to making mechanical toys sustain themselves against the ceiling by rapid screw rotation on a vertical axis; and I cannot help feeling that had Mr. Maxim devoted as much energy, ingenuity and means to the application of power to horizontal screws, depending on these for his lifting power, and using aeroplanes as auxiliaries only, he might be to-day much nearer the end which he seeks. I venture this opinion after pretty careful study of the flight of various orders of insects and of birds, and after following pretty closely the mechanical experiments of the last thirty years.

Mr. Maxim, by his wonderfully ingenious boiler and motor, has solved the chief difficulty as to power, and ascertained many other important facts as to form of propeller, etc. Let him now perfect an adjustable and reversible screw, to be applied at first on the horizontal plane for lifting and then gradually to be brought to an oblique angle for propelling forward, and the next great problem is solved. Laterial dirigibility is easily controlled by cuneiform rudders fore and aft; while soaring power could be gained when once in the air by long aeroplanes of relatively narrow dimensions in the line of direction, to be held vertically in ascent and brought to the horizontal position during forward movement. Safe descent under such conditions will be far more thoroughly within control, and



MR. MAXIM'S FLYING MACHINE.

cording devices, in fact, everything about the mechanism has been beautifully done and represents great originality and inventive power.

The two dynagraphs are good illustrations in point. One of them indicated the lift off the hind axletree, the platform of the machine being so attached to the axletrees as to constitute a sort of weighing machine, and any change of weight resting on the axletrees being shown on the cylinder, which turns once round in 1,700 feet. The other not only recorded the lift on the forward axletree, but made a diagram which recorded the speed with which the machine was passing through the air.

It must not be forgotten that the mechanism in all its parts had been repeatedly tested at various steam pressures, and that the casualty of July 31 was really due to its almost unanticipated lifting power under high pressure. Most of the test trips had been made with a lifting effort of not more than 3,000 pounds, a steam pressure of not more than 200 pounds to the square inch, and a maximum rate of speed of 35 miles an hour, as it was difficult to stop the machine at a greater rate. But on the last test made Mr. Maxim raised the steam pressure to 320 pounds to the square inch, and the velocity and lift were beyond the holding power of the retaining guides, and the machine broke away, first by bending and breaking the rear axle and then by the forward retaining wheel on the underside of the left retaining guide breaking away. Being thus lifted away from the guides at three points, the momentum broke the heavy retaining timbers to the right, some of which became entangled in the framework (the engine being already stopped), and the machine embedded its wheels in the ground.

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Mr. Maxim has thus demonstrated his ability to soar by mechanical means on a scale which will permit a greater lifting power than that necessary to carry the men and machinery, and there can be very little doubt that he will ultimately succeed in soaring through the air, and thus add, as he designs to, one of the most unique and most formidable engines of destruction in modern warfare.

But my visit only confirmed a belief which I have long held, viz., that the practical solution of aerial transit by mechanism is not to be found in imitating the soaring of birds, or other animals, but rather in imitating the fish and by use of adjustable screws, the inclined aeroplane to be used only as a means of reducing power when momentum is once attained. This would involve the use of a float in the form of bags of hydrogen gas to assist the vertical screw thrust as lifting power.

Mr. Maxim for lateral dirigibility depends on the slackening or stoppage on one or the other of his propellers, and as the lifting power depends on the angle of incline of his aeroplanes, there can be no use in reverse screw power. Hence the difficulty when once in the air of easy and safe descent. The management of the machine, in air, and the proper control and security of such vast canvas surface, with the now well known variability in the wind gusts, must always be risky, if not absolutely unsafe.

I have been deeply interested from a boy in the subject of aeronautics, and years ago amused myself in making mechanical toys sustain themselves against the ceiling by rapid screw rotation on a vertical axis; and I cannot help feeling that had Mr. Maxim devoted as much energy, ingenuity and means to the application of power to horizontal screws, depending on these for his lifting power, and using aeroplanes as auxiliaries only, he might be to-day much nearer the end which he seeks. I venture this opinion after pretty careful study of the flight of various orders of insects and of birds, and after following pretty closely the mechanical experiments of the last thirty years.

Mr. Maxim, by his wonderfully ingenious boiler and motor, has solved the chief difficulty as to power, and ascertained many other important facts as to form of propeller, etc. Let him now perfect an adjustable and reversible screw, to be applied at first on the horizontal plane for lifting and then gradually to be brought to an oblique angle for propelling forward, and the next great problem is solved. Laterial dirigibility is easily controlled by cuneiform rudders fore and aft; while soaring power could be gained when once in the air by long aeroplanes of relatively narrow dimensions in the line of direction, to be held vertically in ascent and brought to the horizontal position during forward movement. Safe descent under such conditions will be far more thoroughly within control, and I am of opinion that it is along these lines that ultim ate success will be attained.

The whole skeleton of Mr. Maxim's machine is made of cylindrical hollow steel tubing, manufactured in France. In future he proposes to use oval-shaped tubes, so as to offer less resistance to the air. Mr. Maxim has found that aluminum is useless and unworkable for his purposes.

There is a current belief that, deterred by the late accident, Mr. Maxim intends abandoning further experiment. All interested will be glad to learn that this is not so. I found the men under the intelligent superintendence of Mr. Roberts all busy repairing the breakages, and Mr. Maxim occupied, as far as his engagements with the Maxim-Nordenfelt Co. will permit, in devising improvements and means of overcoming past difficulties.

Margate, August 24, 1894.

* Mr. Maxim's paper is given in full in our SUPPLEMENT of this week, No. 979, and in SUPPLEMENT No. 976 will be found some twenty figures of details.

Connecting Metal to Earthenware.

The portion of the earthenware with which connection is to be made being unglazed, or the glaze having been removed, it is coated with plumbago, and placed in an electrolytic bath, whereby a firm metallic coating is obtained. The lead pipe is then soldered to this coating by a plumber's "wiped" joint. By this means are avoided the imperfect joints made with India rubber sleeves, washers or putty.

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[FROM POPULAR ASTRONOMY.]

THE PLEIADES.

WM. W. PAYNE.

As a group of stars the Pleiades has attracted more attention, in ancient or in modern times, than any other cluster known to astronomy. When above the horizon the group is easily seen by the naked eye because of its definite outline and its bright and beautiful light. Long ago the sacred writer said of it: "Canst thou bind the sweet influences of the Pleiades?" Whatever that may mean, in fact or figure, it certainly cannot be less than the mystic reveries of those ancient untutored races who saw in them the seven beneficent sky spirits of the Vedas and the Zendavesta, and the abode of Deity himself, became the center of the universe. The time of the Pleiades was the beginning of the year for some primitive peoples; for others, the midnight culmination of the group was the sign for great feasts and royal mercy and favor for every petitioner. Even now savage Australian tribes dance in honor of the "Seven Stars," because they are good to the black fellows.* They are called "the hoeing stars of South Africa, and their last visible rising after sunset is, and has been, celebrated with rejoicing all over the southern hemisphere as betokening the waking up to agricultural activity." The influence of the Pleiades has been widespread and unique in all time, and modern science has not yet set a limit to the wonders of their starry realm.

At the present time six stars of the group are easily seen by the naked eye. Their names are: Atlas, Alcyone, Merope, Maia, Taygeta and Electra. By referring to the accompanying plate these and others less bright may be readily identified. The two bright stars on the left hand side are Pleione and Atlas. Pleione is above Atlas and they are midway in the plate from top to bottom. Alcyone is in the middle of the plate, with three little stars on the left and surrounded with a faint nebulous halo. The wonderful Merope is next and a little below. It looks somewhat like the nucleus of a telescopic comet with the tail pointing downward and to the right. The star and the nebula bear the same name and are wonderful objects. Notice the numerous parallel channels in that vast nebulous mass. Maia is next above, forming nearly a right-angled triangle with Alcyone and Merope. It is surrounded by a nebulous halo. A little to the right and above is Taygeta. The sixth bright star, Electra, is on the right side of the plate about midway from top to bottom. It has a nebulous streak from it to the left. Stronger eyes will see five more stars in the group. Pleione is one, the two stars by the one name, Asterope, looking as one just above Maia, make two usually harder to see by the unaided eye. The third is Celæno, nearly midway between Taygeta and Electra, and the fourth and fifth, not especially named, are seen respectively at the bottom and the top of the plate. Alcyone is a 3d magnitude in brightness, Electra and Maia are about 3·8 magnitude, Maia is 4th, Merope and Taygeta are not so bright as Maia by respectively a quarter and a half magnitude, and Celæno is a 7th magnitude.

The word Pleiades is from the Greek, meaning full or complete, so that it is not certain that the name limits the number of stars visible to the naked eye in ancient times, although the number seven is frequently applied to the group in such records. However, it seems probable that seven stars could be as easily seen in the past as the six that are now commonly visible. Professor Pickering suggests the probable explanation from a study of its spectrum that Pleione is the missing Pleiad, as its variable character might account for its fall to 6·2 magnitude. The record of naked eye observations on this group of stars is an instructive one. Moestlin in the time of Kepler saw 14 and mapped 11 with surprising accuracy. This was before the time of the telescope. Miss Airy, of England, has marked the places of 12. Carrington and Denning have counted 14, and Carl von Littrow spoke of seeing 16, and that 11 were frequently perceived.

An opera glass helps the eye amazingly in the study of the group in regard to color and number. Nearly one hundred stars come out at once on the astonished gaze, 25 of which are of the 7th magnitude or brighter, with many others less bright, and yet distinct enough to count with certainty.

In a region about Alcyone covering an area of 135′ by 90′, M. Wolf, in 1876, catalogued at the Paris Observatory 625 stars to the fourteenth magnitude. MM. Henry's sensitive plates showed in a smaller space 1,421 in 1885, and by four hours' exposure in 1887 the same space revealed the astonishing number of 2,326, including stars undoubtedly as small as the sixteenth magnitude. The meaning of this statement may be more fully realized when we remember that the sharpest eye unaided can never see well, at one time, more than 2,000 or 3,000 stars. Before the time of telescopes the total number of stars that the ancient observers could see well enough for record was 1,100. The marvelous thing in the count on the Henry photograph is the fact that 2° 15′ by about 1° 30′ of the space occupied by the Pleiades group contains stars enough to fill the whole sky, if the 2,326 were brought near enough to us and sown broadcast in the sky as the lucid stars now appear.

The accompanying plate covers a little smaller area than the Henry photograph just referred to, and our reproduction from the original negative has occasioned the loss of many of the stars plainly shown in making positives or pictures of any kind from the original photograph.

Another useful line of work on the Pleiades group is the measurement of the distances and positions of all the principal stars from the central one, Alcyone. This has been very carefully done three or four times during the last fifty years, so as to obtain data for the study of the relative motions of these stars in order to learn something about the physical constitution of the group. Dr. Elkin, of the Yale Observatory, has also recently done some work of a similar kind by the aid of a fine heliometer, which is sometimes called a survey of the Pleiades by triangulation. His results are useful in getting the exact time of the occultation of stars in the group by the moon as she moves rapidly through it, by knowing the exact place of each star so occulted.

The most surprising advance in our knowledge of the Pleiades is the discovery of vast nebulous masses scattered over a large portion of the area of this cluster. If we except some earlier accounts that seem doubtful, the first observer that called attention to nebulous matter in the Pleiades was Tempel, an Italian astronomer, in the year 1859. His drawing is found in No. 5 of the publications of the Milan Observatory, and represents a hazy, comet-like mass surrounding Merope and extending southward from it to the distance of half a degree. In 1882 Mr. E. E. Barnard, then of Nashville, Tenn., observed this nebula

The Pleiades Nebula and Trail of Asteroid No. 203 Pompeja.—From a photograph by H. C. Wilson at Goodsell Observatory January 30, 1894. Exposure 4 hours.

with a small telescope and made a drawing of it which was published in No. 3 of the Sidereal Messenger of that year. Quite generally, however, astronomers were in doubt in regard to the existence of this nebula, some claiming that search for it with first class instruments had been fruitless, while others maintained that its extreme faintness made its form and extent very uncertain. In 1886 the Henry brothers, of Paris, photographed the Pleiades cluster, showing plainly traces of the nebula that could not be mistaken.

In the years immediately following the study of the quality of photographic plates was vigorously pushed forward, until in the years 1888 and 1889 the highly sensitive film came into use, after which it became possible to get by the aid of such plates most wonderful details in nebular structure never before dreamed of. The strange and complex background of this cluster as seen in our picture is a good example of the progress in astronomical knowledge which has been made by the aid of photography in many directions.

A few years ago the best telescopes visually gave only hints of what we now photograph easily with small instruments. In this cluster the stars Alcyone, Merope, Maia and Electra are all involved in this vast nebulous mass. Alcyone seems to be separated from the others except by a branch from its surrounding nebula that makes a crooked path to the main nebula, involving the other three stars, and which can be traced right through that nebula, as a line of light, to the star Electra. Another faint line of light may be traced through three stars above Alcyone which is nearly parallel to the streak just mentioned. Other similar features can be seen on the original negative, but mention of them here is not necessary in order to give the reader a good general idea of the beauty and excellence of photographs that can be made at the present time with instruments adapted to such kind of work.

As we close this description of the Pleiades, we must call attention to the little planet trail of Pompeja, asteroid No. 203, which will easily be found near the right hand lower corner of the plate. Its place is three-quarters of an inch from the bottom and about one fourth of an inch inward from the right hand side. The trail is about one-sixteenth of an inch long, and although rather faint, when once seen, it will afterward be recognized at a glance. It ought also to be added that the negative from which this plate was made also contained the trail of another asteroid, which was detected on it by the careful scrutiny of Dr. Wilson, of Goodsell Observatory. The last-named asteroid proved to be a new one; so Dr. Wilson has been credited with the discovery of it.

* Clute's System of the Stars, p. 221

The Fall in Prices.

The American Grocer, in its twenty-fifth year anniversary number, publishes the prices of leading articles of food compiled from its market reports for twenty-five years. The prices given are wholesale prices, and the changes are quite remarkable, as illustrated by the following table:

	1869.	1894.
Flour, per bbl.	$6.62	$3.30
Sugar, per lb.	.13⅞	.04⅜
Coffee, per lb.	.15⅞	.18⅞
Tea, per lb.	.59	.20¾
Rice, per lb.	.06¾	.04½
Mess beef, bbl.	11.41	8.19
Mess pork, bbl.	31.01	13.80
Lard, per lb.	.18½	.07⅝
Butter, per lb.	.25½	.25½
Cheese, per lb.	.14	.10⅝
Canned tomatoes. No. 3, doz.	2.10	.95
Canned corn No. 2, doz.	2 75	.80
Canned peaches No. 3, doz.	3.50	1.30
Canned salmon No. 1.	3.75	1.55

The only item which is higher now than in 1869 is coffee, and this article has, during the twenty-five years, fluctuated between 9·01 and 19·72 cents per pound. The coffee market is just emerging from a period of high prices and is now tending downward. Dairy products have also fluctuated largely and are now above a parity with other articles of food, but the tables of the American Grocer, which are given for each of the last twenty-five years, illustrate quite as marked a tendency toward lower prices for nearly all varieties of food as is seen in other lines of production.

The all-rail rate on grain from Chicago to New York, which was 70 cents per hundred pounds in 1869, is but one-third that amount in 1894. The rate on live stock and dressed beef was 95 cents in 1872 and 45 cents in 1894. Dry goods from New York to San Francisco in 1860 paid $6.50 per 100 pounds and in 1894 one-half that sum. Carloads of fruit from California to the Atlantic seaboard cost $4.20 per 100 pounds in 1869 and $1 per 100 pounds in 1894. Dry goods from New York to Chicago were charged $1.50 per 100 pounds in 1869, 75 cents in 1894. In 1869 the N. Y. C. R.R. averaged over 2 cents per ton per mile on all its traffic, while the average now is 7 mills per ton per mile; the Illinois Central charges have in like manner fallen from 2½ cents to 9 mills per ton per mile, and the Louisville and Nashville from 3 3-10 to 1 cent. Ocean freights have fallen in equal measure. Wheat which paid 13 cents per bushel from New York to Liverpool in 1869 is now being carried for 4½ cents. Inventions, machinery, and competition have done it.

Within twenty-five years the national debt per capita has been reduced from $64.43 to $12.55, a steady decrease which, in connection with increasing population, has made the burden of taxation comparatively light.

In 1869 the government paid in interest $3.32 for each inhabitant, while that charge in 1893 was only 34 cents. On the other hand, the sense of the nation's obligation to the survivors of the civil war was so great that the charge for pensions was increased from 78 cents per capita in 1869 to $2.37 in 1893.

The net ordinary receipts of Uncle Sam in 1869 were $9.82 per capita, against $6.91 in 1893.

Storage Battery Traction in Paris.

The accumulator cars, which have been running for some time on the lines of the Northern Tramways Company, of Paris, appear to be proving fairly satisfactory, as the cost is reported to work out at about the same as horse power on the Paris lines. The cars are arranged to seat fifty-two persons, and run at a speed of about 7½ miles an hour within the city limits, which outside is increased to 10 miles. Inclines of about 4 per cent have to be mounted at certain parts of the line, and each car runs 80 miles a day. The motive power is supplied by a battery of 108 cells, having eleven plates each. These cells are fitted into twelve cases. They are coupled in four groups of 27 cells each, the electromotive force of each group being about fifty volts. The groups can be arranged either in parallel or series, so that a wide range of speed is at the service of the driver. The two motors which drive the car can also be coupled in series or parallel. The total weight of the car, with accumulators and passengers, is twelve tons, the weight of motors and accumulators being about four tons.

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THE FORT WAYNE ELECTRIC CORPORATION—ITS DYNAMOS AND GENERAL ELECTRIC LIGHTING APPARATUS.

The Fort Wayne Electric Corporation has, during the last year, attracted considerable attention by its secession from the General Electric Company. Originally it was one of the members of this consolidation, which includes the Edison and the Thomson-Houston companies. In carrying out the combination it was proposed to close the Fort Wayne works and make the apparatus at Schenectady. This was opposed by the president of the Fort Wayne corporation, and, as a result, it left the consolidation and is established on its own responsibility again. The works are of large size, occupying some twelve buildings in Fort Wayne, Ind., the buildings practically covering a large block of ground. Eleven years ago, the Fort Wayne Jenney Electric Light Company occupied a single small building. The present great concern is the outcome of this building, and its president, Mr. R. T. McDonald, it is interesting to note, was one of the organizers of the original company, whose charter dates from the fall of 1881.

At present the company is engaged in the manufacture of apparatus under the Wood patents, Mr. James J. Wood, the present electrician of the company, being the inventor. The apparatus manufactured includes all the details as well as the generating apparatus for arc and incandescent direct current and alternating current lighting, and our illustrations show not only some of the great dynamos made by the company, but also some typical pieces of apparatus which illustrate the minor features.

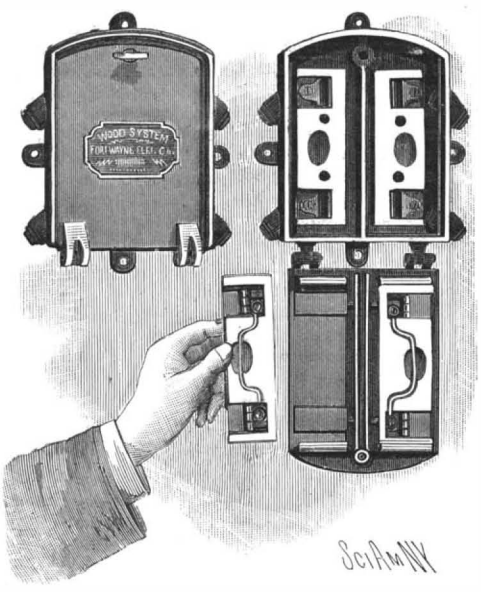
We illustrate in Fig. 1 the Wood automatic dynamo, designed for arc lighting by direct currents, one of the standard sizes for this machine being for eighty 2,000 candle power lights. This machine possesses the Wood automatic regulator, which perfectly controls the action, enabling the machine to give a constant current whatever changes of resistance may occur on the lighting or other circuit. This operation is effected by an automatic shifting of the brushes. We illustrate an experiment shown in which the machine is absolutely short circuited without producing any disastrous results, a brilliant arc appearing at the point of connection. Another test is throwing on or off fifty or more lamps at once, which can be done with the production of scarcely any sparking on the commutator. The experiment in short circuiting we illustrate as performed with the 80 arc light machine alluded to above, and in another cut, Fig. 2, we illustrate the giant constant current 125 arc light machine. On this appears very distinctly the automatic regulator. To one side is seen one of the workmen producing a long metallic arc by drawing apart metallic terminals connected to this machine.

One of the most striking pieces of apparatus produced by the factory is the great 6,000 incandescent light alternator given in Fig. 3 of the illustrations. The general construction of the dynamo proper is shown in the cut. It is directly connected to a 300 horse power Ball cross compound engine. The field is of cast iron, with radial pole pieces projecting inwardly, in whose ends slots are cast to prevent Foucault currents. The winding of the pole pieces is compound. Back of the main dynamo and driven by a belt upon a shaft will be seen a comparatively small direct current dynamo. This is the independent exciter. A current from it is taken to the field, carried by comparatively fine wire wound in four coils on the field pieces of the alternator.

The shaft of the alternator carries next to the armature face a commutator from which a rectified or direct current is taken to the field. Heavier wires wound upon the field carry the rectified current. The result of this system of compound winding is that the dynamo is self-regulating. Outside of the commutator on the shaft are seen the two collecting rings, whence the alternating current is taken to the line. The armature of the alternator is made of sheet iron stampings, and its winding is composed of copper ribbon. A field of 51,000 lines of force per square inch is maintained, and three and six-tenths feet of armature conductor per volt is employed. The efficiency of the machine is 95 per cent. It makes 240 revolutions per minute.

The alternating current is recognized as peculiarly adapted for arc lights, as it insures equal combustion of the positive and negative carbons, and the Fort Wayne Corporation makes a specialty of the full arc plant of this type. The transformer made by them, also due to Mr. Wood, possesses several special features. Mica insulation is used. The cores are wound by machinery, in doing which mechanical counters are used to determine the number of turns of wire to maintain the desired ratio of reduction. When the correct number of turns is reached, a bell rings to notify the operator. After the coils and cores are stacked up, they are placed in the iron case. This is a cast iron box provided with a number of projections on its inner surface to prevent the coils lying against its side, so as to insure ventilation. An opening at the bottom admits air, and a weather-proof cap at the top covers another opening. The iron box is in magnetic connection with the cores so as to form a portion of the magnetic circuit. One of our illustrations shows one of the lamps connected with the converter, above which is seen the primary fuse box.

This embodies several new features. The fuses run across porcelain blocks, in whose center is a depression determining the point of fusion, so that if a fuse blows out, the contacts are not injured. As a measure of safety the cover is so arranged that the act of opening the box breaks the circuit on both sides, so that the fuses can be examined with perfect safety.



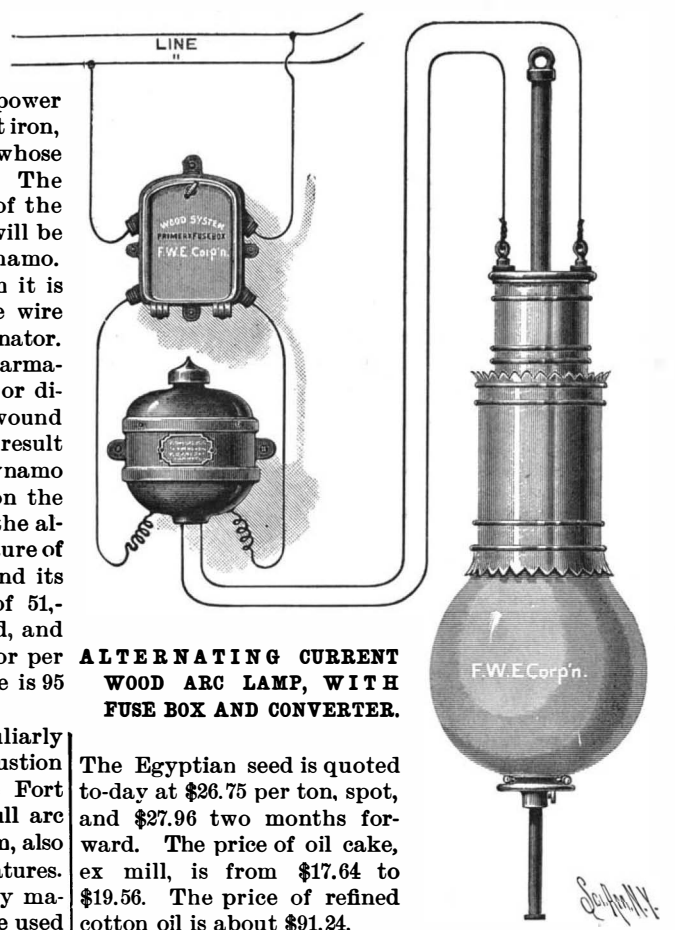
THE WOOD FUSE BOX.

In the near future the Corporation is expected to enter the field of electric railroad work. In this event it is fair to assume that some important developments may be looked for in this department, where so much work has already been done by others.

The English Cotton Seed Oil Industry.

Lorin A. Lathrop, Esq., United States consul, Bristol, England, in a report to the State Department, says: There are a considerable number of seed-crushing mills in England, nearly all of which crush cotton seed. None of these mills have any connection with the American Cotton Seed Oil Company of the United States. They are independent of each other and of any controlling organization whatever.

They obtain their entire supply of cotton seed from Egypt. From 15,000 to 20,000 tons are annually imported into the Bristol district. Cargoes are purchased through London brokers, who guarantee weight. The freight from Alexandria to the port of delivery runs at the present moment from $1.94 to $2.19 per ton.



ALTERNATING CURRENT WOOD ARC LAMP, WITH FUSE BOX AND CONVERTER.

The Egyptian seed is quoted to-day at $26.75 per ton, spot, and $27.96 two months forward. The price of oil cake, ex mill, is from $17.64 to $19.56. The price of refined cotton oil is about $91.24.

Egyptian cotton seed comes unmixed with fragments of cotton fiber. It is therefore easier to handle than the American seed. There is a further important consideration: Insurance is a great tax upon seed-crushing mills, and I understand that the premium is considerably enhanced where the American seed with its adherent fiber is either handled or stored.

The seeds are crushed undecorticated. The oil cake has not, therefore, the excellent appearance of the American cake made from the decorticated seed; but the hardness of the American cake militates against sale and price. "That last pinch of the screw," said a man to me, "is what hurts the cakes. You don't want to pave the floor with them; you want to feed them to cattle." The oil expressed from the seeds finds a market in the soap factories, in the fish-frying shops, and in the Mediterranean.

Protection of Fruit and Vegetables in Transit.

A bulletin which has just been sent out by Professor Mark W. Harrington, Chief of the Weather Bureau, gives the opinions gathered from many shippers of perishable products throughout the country in relation to the proper protection of fruits and vegetables by heat and cold during transportation. These men generally concur in the statement that the danger in transportation from freezing has been eliminated by modern methods. The so-called lined car, which has a partition of tongued and grooved boards at the sides and ends, placed so as to leave an air space of about four inches, answers for spring and autumn and during most winter weather, while the Eastman heating car in extreme weather has proved a perfect protection. Perishable goods can be shipped with safety in ordinary freight cars when the outside temperature is twenty degrees Fahrenheit, and in refrigerator cars when it is ten degrees. Fruit wrapped in heavy brown paper will endure fifteen degrees more cold than if it is not so wrapped. Dampness is very injurious, and products which are shipped in a dry condition can endure a much lower degree of temperature without injury than under moist conditions. It should always be remembered that the kind of packing which keeps out the cold will keep in the heat, so that there is often more danger from heating by process of decomposition than from injury by the cold. When a north wind is blowing on the prairie, cars which contain fruit are often covered with canvas on the north side. Oranges that have been frozen may be thawed without injury by putting them in cold water or in tight barrels immediately after arriving, allowing them to thaw out gradually. These are some of the points picked almost at random from what is altogether a most instructive circular.

Ornamenting Glass.

BY A. GORLITZ, ZURICH.

The design or inscription is first engraved on a printing plate, for which rubber is a suitable material; the design being engraved positively, that is to say, in the same way as that in which it will be afterward seen. The plate is then coated with varnish color and pressed upon a glass plate. The glass plate is strewed with bronze powder, sheet aluminum or other suitable material, the portions forming the design or inscription remaining empty, and being, therefore, transparent. The glass plate is then placed in a frame having a backing of strong paper board, on the front face of which is mounted a brilliant sheet of tinfoil or tin plate, provided with prominent squares placed in suitable positions. The design is thus shown by a brilliant reflected light visible through the transparent part of the glass, the other portion of the glass forming a backing stamped in relief.

Heretofore raised enameled writing and designs in relief on glass have been produced by means of a brush and thin enamel paint. The inventor uses stencil plates, preferably of tinfoil or other flexible material, and a composition made of glass powder, made up to the consistency of treacle, with turpentine and "glaze." The composition is applied with a spatula through the openings of the stencil plates, and the article is then fired. If the surface on which the design is to be produced is irregularly curved, or is curved both ways, the stencil is applied to sized paper, and the design is transferred from the damped paper to the glass or ware.

Liquid Fish.

Fish are reduced to small pieces, mixed with a suitable quantity of water and cooked in a close vessel by means of steam, the temperature being raised to 160°—170° C. When all the soluble parts have been extracted by the water, the liquid is first passed through a sieve, and after skimming off the fatty matter, it constitutes the fish essence, which may be used as food, either alone or in conjunction with other nutritious substances. The waste parts of the fish, together with what remains on the sieve, are used for manure, after being first mixed with a suitable amount of lime, clay, or similar diluent.

Insulating Material.

Ozokerite, asphalt, and amber are subjected to distillation in a closed still to a temperature of 400.° After the mass has been heated until gases, vapor, or oils cease to escape, it is allowed to cool. In that condition it is of pliable consistency, and may either be used alone or incorporated with other substances for insulating cables, such as resins, fats, or oils, the proportions of these being from 30 to 70 per cent. By this method those substances present in fossil resins which prejudice or deteriorate the insulating properties are removed.—A. Gentzsch, Vienna.

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RECENTLY PATENTED INVENTIONS.

Engineering.

BLOWER.—Thomas Kitson, Stroudsburg, Pa. This is an improvement which may be applied to an ordinary furnace without changing or renewing the grates, enabling an even steam pressure to be kept up with the use of cheap fuel. It comprises a pipe with bell-shaped mouth through which extends a steam nozzle delivering in the pipe, an approximately conical valve being secured to the nozzle and held within the mouth, the valve being adjustable in and out upon the nozzle to permit the passage of the requisite quantity of air. The device is of simple construction and adapted to create a very strong draught.

Railway Appliances.

CAR COUPLING.—John J. Schairer, Clint, Texas. This improvement comprises a knuckle pivoted in the drawhead and provided with cam surfaces on opposite sides of its pivot, an arm mounted to swing being adapted to engage the cam surfaces to open and close the knuckle and to lock it in either open or closed position. The improved coupling is of simple and strong construction, designed to prevent accidental uncoupling, and permit of coupling without the brakeman going between the cars, while also adapted to the coupling of cars of different heights.

CAR COUPLING.—James O. Miller, Rochester, Ind. According to this invention the drawhead is arranged to rock laterally in contact with a supported spring-cushioned yoke piece, there being a slidable spring-retracted drawbar whereon the drawhead rocks and slides, while a spring-pressed arm vibrates in a side slot of the drawhead, a pivoted link swinging laterally thereon. A hook having an elongated limb is pivoted in an opposite slot of the drawhead, a spring throwing forward the limb of the hook. Cars provided with this coupling are automatically coupled as they come together, the uncoupling being effected from either side, and the device may also be used in connection with the ordinary link and pin coupling.

EXPRESS CAR.—Miguel Morell and Ramon M. Ferrer, Santa Barbara, Cal. This is a burglar-proof car with cages which can be opened only from the outside, to contain safes and valuable parcels, and accessible only to the depot man at the station to which consigned. If robbers enter the car they will be exposed to the fire of the messenger, in a bullet proof compartment, which is so arranged that the messenger may also protect the engineer and shoot along the sides of the car without exposing himself.

Electrical.

CUT OUT.—Elmer E. Hersh, Denver, Col. This device is more particularly designed for electric cars, and comprises a revoluble cylinder over the face of which extends a series of fuse wires introduced in succession between contact springs connected with the conductors as the cylinder turns, the fuse wire melting and the circuit being broken when the current exceeds the prescribed strength. Each motorman is preferably supplied with an extra cylinder fitted with fuse wires, so that when all the wires of one cylinder are melted, it may be easily replaced by a cylinder containing a full set of wires.

Mechanical.

MECHANICAL MOVEMENT.—William W. Beaumont, London, England. This invention comprises a spindle journaled in bearings on a suspended device, a rotatable link being connected with the spindle, and an unbalanced weight on it. It is especially designed to impart a gyratory motion to sieves, such as sifters in flour mills, coal screens, machines for sizing and sorting grain, etc., to advantageously replace the ordinary crank mechanism, avoiding excessive wear and harmful vibrations.

WIRE FORMING MACHINE.—Frank H. Howe, Port Townsend, Washington. This is a machine for forming rods or wires from metal disks or plates. A rotary spindle carries the disk from which the rod or wire is to be formed, a feed mechanism feeding the disk to rotary cutters for cutting the strip, which passes between drawing rollers, whereby the disk-carrying spindle is rotated, the drawing rollers and cutters being simultaneously operated by gearing. The disk is thus cut into a continuous strip of wire or rod of any desired cross section.

Agricultural.

PLOW.—Thomas J. Kelly, Tolosa, Texas. The share of the plow designed by this inventor is readily and quickly removable, being connected with the shank of the beam and with the wing or other support by a locking connection not involving the use of bolts. The handle of the plow may also be readily adjusted to suit the plowman, and all braces and other like barriers, usually located at the back of the wing, or share, or land side, are dispensed with, thus allowing the plow to run free. The clevis also is of peculiar construction, being adjustable as to position to bring the team into desired draught, and a single or double tree may be attached directly to the clevis.

PULVERIZING CULTIVATOR.—Henry Strasser, Thornburg, Iowa. This is an improvement on a formerly patented invention of the same inventor, providing for such construction that two teeth-carrying bars may be located at angles to one another and adjustable upon a yoke, to accommodate the cultivator to rows of varying width. A double cultivator is also so made that either one of the sections may be used as a single cultivator. A simple and inexpensive attachment facilitates the adjustment of each section upon the yoke, and the teeth are adapted to thoroughly pulverize the ground and effectually remove weeds.

CORN HARVESTER.—Winfield S. Osborn, Gilboa, Ind. This is a construction capable of ready attachment to the box body of any wagon, the harvester, as it is advanced along a row of corn, stripping the ears from the stalks and delivering them at the rear, where the ears are stripped of their husks and silk and the husked ears delivered to an elevator to be conveyed to the box of the wagon. The driving shaft is driven from the axle of the vehicle, and pivoted in the main frame is a working frame, in an inclined forward slotted end of which work longitudinal spiral rollers, over one of which are stripping bars moving in opposite directions. At the rear open end of the working frame is an endless apron, adjacent to which are the husking rollers, the faces of which may be either smooth or roughened.

COW MILKING MACHINE.—William B. Bland, Maquon, Ill. This is an improvement on a formerly patented invention of the same inventor, simplifying the construction and improving the action of the milking fingers, the means of adjusting the fingers and their carrying frame to different positions, the main frame and driving mechanism remaining the same. The milking fingers consist of a series of leaf-like spring leaves provided with tension devices designed not to injure the surfaces with which they come in contact, and resembling in their action the pressure of the fingers of the hand.

DRAUGHT EQUALIZER.—Henry Sturm, Nauvoo, Ill. This invention relates more particularly to four-horse eveners for use with either right or left tongue, or tongueless gang plows. The evener devices are so arranged that the plows can be drawn to work close up to the ends of the field, the front draught being changed to right or left to take more or less land and allow more space for the horse in the furrow without crowding others. The construction is simple and inexpensive, and the several parts can be readily assembled and adjusted, and easily replaced in case of breakage.

Miscellaneous.

CABLE GRIP FOR LOGGING, ETC.—Gilbert Gagnon, Nanaimo, Canada. In the use of this device the drag or resistance of the log or other object being hauled, and also the draught of the cable, are utilized to hold the jaws closed on the cable. The body of the device has a fixed jaw and is formed with a rounded surface on its under side to act as a runner, a rearwardly extending arm carrying an idler around which the rope passes, while a movable jaw is pivoted on a lever fulcrumed above the fixed jaw, and a rope connects the lever with the log or other object to be hauled.

PRINTING PRESS.—Daniel Maurer, Middle Village, N. Y. In this press the type bed is held in vertical position when the press is being operated, but may be given a rearward inclination to facilitate securing the type in a frame or chase on the bed. The platen is pivoted, and held normally in such position that it will bear against the frame of the type bed through the medium of springs, the operation of a hand lever causing the platen to approach the type bed with a quick movement. The construction is simple and worn parts may be readily replaced.

DRYING MACHINE.—Peter Cooper Hewitt, New York City. This is a machine particularly designed for spreading melted glue or gelatine into sheets and drying and delivering it in commercial form, and the invention consists in an endless apron supported on drums and traveling through an evaporating chamber heated by steam or hot air, there being also a device for cleaving the dried sheet of glue or gelatine from the apron as it emerges from the machine. The flow of liquid glue to the apron is regulated according to the speed of the apron and the evaporating power of the air passing through the evaporating chamber. The machine is made of different lengths to adapt it to drying films of different thicknesses without producing bubbles.

FIBER DRYING APPARATUS.—Willy Saulmann, Berlin, Germany. An apparatus for conditioning textile fibers has been devised by this inventor, providing means whereby a dried and heated current of air is passed through the fiber-holding receptables, the latter being surrounded by hot air, so that the textile fibers come in direct and indirect contact with the hot air current. The weighing of the receptacles takes place not during the conditioning itself, but after its termination and the cooling of the receptacles.

ALUMINOUS CAKE.—Jean V. Skoglund, Brooklyn, N. Y. This cake consists of sulphate of alumina, ferrous iron, an excess of a stannous compound, and a stannic compound, and the invention provides for making it by reducing aluminum sulphate free from ferric iron by treating the crude material, as bauxite, with sulphuric acid to dissolve the aluminum oxide and the iron oxide, adding a weaker reducing agent, such as sulphurous acid or a sulphite, then heating the solution, and finally adding any stannous compound, and continuing the heating until all of the ferric iron is reduced. The product is especially suited for the sizing of paper pulp without darkening or reddening the pulp.

COMPOSITION FOR TANNING.—Jesse B. Hodges, Salem, Ark. Extract of palmetto root, stramonium, gambier and salt, in stated proportions, with water, form this patented composition, with which it is designed to tan light hides in two days, and the heaviest hides in twenty days, at a cost of about three cents per pound to the tanned leather. The hides are to be limed, unhaired, fleshed, and bated, in about the usual way, and plunged and handled in vats in liquor made with the composition. It is claimed that the palmetto roots contain twice as much tannin as oak bark, and that extract can be made therefrom for much less than oak bark extract.

BIT STOCK.—Francis M. Hay, Erie, Pa. According to this invention, there is an elastic or yielding screw connection between an outer sleeve and the stock proper, the screw connection having a slot or channelway across its threads, so that a screw segment may be slid longitudinally therein to close quickly the jaws, and the other sleeve then turned with a rotary axial adjustment to tighten the screw connection and give a final clamp to the jaws. Special means are provided whereby the screw segment may be made to more certainly and easily enter into mesh with the other screw threads after having been disconnected therefrom for longitudinal adjustment.

VEHICLE POLE.—Edward Clark, New York City. This pole is made of a metal tube or pipe, and into its rear end extends a metallic bar fastened to the solid wood base of the pole. The base is fitted into a recess in the hounds, where it is secured by rivets and top and bottom plates, and the head, carrying rings, is formed of two flanged sections secured in the end of the pole. This pole is comparatively inexpensive, is not liable to break or bend, and is not flexible, to injuriously bear down on the neck of the animal.

BRIDLE BIT.—Max Lesser, Duncansby, Miss. To facilitate managing an unruly animal and prevent him from breaking loose when hitched to a post, this inventor has devised a bit comprising cheek pieces and a main mouth bar cranked between its ends and having a surface groove throughout its length, while an auxiliary mouth bar pivoted in the cheek pieces has a crank and lies wholly within the groove, there being operating cranks at the ends of the auxiliary mouth bar. There are slides on the cheek pieces linked to the end cranks, and levers pivoted to the upper ends of the cheek pieces and slides.

VEHICLE SEAT CORNER IRON.—Charles C. Field, New York City. An angular body is, according to this invention, fitted into the corner formed by the side and back of the seat, an inwardly projecting flange resting on the seat bottom, while a top portion has a flange adapted for engagement with the outer faces of the seat back and one of the sides, being so curved as to avoid forming an angle at the corner. The iron is readily applied, and is inexpensively made in a single piece.

PACKAGE.—Marion J. Meeker, Puyallup, Washington. This is an inexpensive device for containing hops, fruit, vegetables, etc., not liable to leak out of small apertures, the package also being readily transformable into a cot bed, and, when made of water proof material, suitable for use as a portable bath tub. Combined with a pair of poles is an attached sack of such width that it may be slipped over the ends of the poles, thus fastening the ends of the sack, trestles being employed when the device is used as a bed, box or bath tub, and looped cords preventing its spreading when mounted on trestles.

REFRIGERATOR.—George A. Green, Rogers, Texas. A cooler for preserving milk, butter, etc., constitutes the improvement designed by this inventor, which operates by the evaporation of water, whereby the contents of the cooler may be kept at a lower temperature than that of the outside atmosphere. The water-holding receptacle has a covering of absorbent material hugging the bottom and entering into the water, while a dish-like water-holding cover has also a covering of absorbent material whose ends adhere to the covering of the body, and a drip receptacle is located beneath the body of the cooler.

CHECK ATTACHMENT.—Robert Sears, Newark, N. J. This is a device for use in connection with an overdraw check to hold the horse's head in position to prevent choking and keep the animal under control. It comprises a bowed frame with rearwardly extending arms, a nose band having its lower ends connected with the rear upper ends of the frame, and a chin strap having its ends connected with the frame at a point in advance of the nose band, the frame being adapted at its front end to receive an overdraw check. In the use of the attachment, the lowering movement of the animal's head causes pressure on the nose and chin straps, but avoiding bruising or pinching.

ACCOUNT KEEPING DEVICE.—Ernest McCulley, Houston, Mo. In a flat-topped case, with detachable name cards on one side, is held a series of paper strips, there being a roll for each depositor in a bank, this device being especially designed for use in keeping bank balances. The strip may be readily pulled along from the roll so that succeeding balances may be easily written on it, the balances coming near the name of the depositor, that they may be easily seen.

STRINGED INSTRUMENT.—John Connery, Long Island City, N. Y.—This is an instrument of the mandolin type, and the invention provides such an instrument having an attachment whereby the instrument may be played after the manner of a violin, by drawing a bow back and forth. The strings are arranged over a convex bridge, by which they are held concentric with a slotted convex guide secured to the top of the instrument, the bow being adapted to move on the guide and having pins or teeth which project through its slot to engage the strings.

FOLDING SNOW SHOE.—Hermann Bremer, Halberstadt, Germany. This shoe is made in two sections, with adjacent overlapping ends, the parts being joined by a pivoted lever or turning clasp to form one connected piece, and the relative arrangement being such as to give the resiliency of a spring to the joint.

BOTTLE STOPPER.—Gilbert L. Matthews, Newton, N. J. This is a stopper for bottles holding gaseous liquids, the pressure of which holds the stopper in place. It is very cheap and simple, comprising a button inclosed by an elastic gasket, the shank of the button being pivoted on the bent lower end of a wire loop, curved portions of which spring apart and engage the sides of the bottle neck.

TRUSS.—Carl B. Rostel, San Francisco, Cal. (608 Sacramento Street, room 2). This inventor has devised an elastic truss belt for the support of abdominal rupture, the belt being adjustable to suit the size of the person, and being provided with pads having an elastic pressure device whereby the tension is adjustable to any part of the pad and to any degree of strength. It also has relieving pads to prevent soreness at points of contact.

Designs.

CENTRIFUGAL MACHINE CASING.—Henry B. Weiper, Durand, Wis. This is a circular casing with upper opening somewhat contracted, and with bottom raised at the center for most of the diameter of the casing.

BASE FOR A GAME APPARATUS.—Frank M. Whiteman, Canton, Ohio. This is a design for a device by which a ball may be thrown or tossed by a trap. It has a hollow cylindrical body, from one side of which extends an arm like the trail of a gun carriage, a slot in this arm opening into the cylinder.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co., for 25 cents each. Please send name of the patentee, title of invention, and date of this paper.

NEW BOOKS AND PUBLICATIONS.

THEORY AND CONSTRUCTION OF A RATIONAL HEAT MOTOR. By Rudolf Diesel. Translated from the German by Bryan Donkin. New York: Spon & Chamberlain. 1894. Pp. viii, 85. Price $2.50. No index.

This monograph describes and explains the theory of an internal combustion engine. The principle on which the engine is based is that coal or other combustible, when burned, produces so high a temperature that a large excess of air (100 parts by weight to 1 part of the combustible) is essential to utilize the heat. The author objects to discharging it at a high temperature from the exhaust, and properly recognizes the water jacket as a great source of waste. The theory of the motor is worked out in the greatest detail, and the work is illustrated by a very full series of figures and plates. On general principles, the want of an index is to be regretted. The Diesel motor is now being tested in Germany, using atomized petroleum for fuel. The petroleum in question, the translator states, is "pulverized," rather a peculiar adjective to apply to a liquid.

F. B. VANDEGRIFT & CO.'S HANDBOOK OF THE UNITED STATES TARIFF. Containing the Customs Tariff Act of 1894. New York and Philadelphia: F. B. Vandegrift & Co. Pp. 547.

This convenient sized book, with very full schedule of articles and rates, contains the new tariff law, and will be found a most useful manual for all interested in commerce between this and other nations. In one thing it is open to criticism. The extensive use of ditto marks in the alphabetical schedule sometimes causes a large number of pages in succession of the index, for such it really is, to be printed without the initial word, which should, of course, have been repeated at the top of each page. Thus, under iron and steel, ditto marks run for some ten pages, so that on opening the index anywhere between pages 371 and 382 it is wholly problematic what the ditto mark refers to, and this can only be ascertained by guess or by turning back a number of pages. The same trouble appears elsewhere. The work, however, is so complete, portable, and well arranged that otherwise we warmly commend it.

STATISTICAL SUPPLEMENT OF THE ENGINEERING AND MINING JOURNAL. The mineral industry, its statistics, technology and trade, in the United States and other countries, from the earliest times to the end of 1893. Vol. II. Edited by Richard P. Rothwell. New York: The Scientific Publishing Company. 1894. Pp. xxx, 894. Price $5.

The Department of the Interior of the United States, in its publication of reports on the mineral resources of the United States, has done excellent service. The present volume to a certain extent carries out the system of the government work alluded to, but on a much enlarged scale, and is far better printed, and with more detail. It will be found a most useful work, and one which any one interested in these topics will be likely to make frequent reference to. A more or less interesting feature of the book is the publication of the portraits of contributors, with abstracts of their lives. It is the second volume, by which the subject is carried down to the end of 1893, and we believe that a new annual volume is to be looked for, which will make the publication one of the most important scientific works of the day.

LESSONS IN QUALITATIVE AND VOLUMETRIC CHEMICAL ANALYSIS. By Charles O. Curtman. Including lessons in qualitative chemical analysis by Dr. F. Beilstein. Saint Louis, Mo.: John L. Boland Book and Stationery Co. 1894. Pp. xii, 295. Price $1.50.

This work is designed principally for the use of medical students and physicians, and like all books written under such restrictions, may seem a little inadequate for its subject, but we do not hesitate to say that, even by those who have gone through a more thorough course with one of the larger works, this will be found an excellent reminder of their studies.

INDUCTION COILS AND COIL MAKING. By F. C. Allsop. New York: Spon & Chamberlain. 1894. Pp. xi, 162. Price $1.25.

Mr. Allsop's books are characterized by their practical aspect. In the present work a very good description with numerous illustrations of the construction of induction coils is given, and one which will be found of interest by many electrical constructors, especially amateurs. It is illustrated by a number of figures, some newer than others, some being advertising cuts. On the whole, the subject is not treated as fully as we would like, but it cannot but be of use, and deserves notice as a notable addition to electrical literature.

MODERN METHODS OF SEWAGE DISPOSAL FOR TOWNS, PUBLIC INSTITUTIONS AND ISOLATED HOUSES. By George E. Waring, Jr. New York: D. Van Nostrand Company. London: Sampson Low, Marston & Company, Limited. 1894. Pp. vi, 252. Price $2.

Mr. Waring appears once more before the public treating of one of his favorite topics. In his graphic and decisive way, he unhesitatingly criticises things generally, which he considers to be wrong, giving his views with a strong and decided expression. By his advocacy and development of the Moule draining process, which as applied in this country has received his name and is known

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as the Waring system, his name has obtained wide currency among suburban residents. He himself, on page 215, says that the term "Waring system" is a misnomer. He says that it would be better to call it Mr. Field's system. But the author's qualifications for speaking of sewage, sewage irrigation and sewage farms give the book an especial value and a peculiar timeliness at the present day, when suburbs are known to offer so important a field for the work of the sanitary engineer. An excellent index is an important feature of the book.

CAVALRY LIFE IN TENT AND FIELD. By Mrs. Orsemus Bronson Boyd. New York: J. Selwin Tait & Sons. 1894. Pp. 376. Price, cloth, $1.

This excellent account of cavalry life in the American army will, no doubt, make interesting reading for many. The preface alone, describing the trials of Captain Boyd, the husband of the authoress, at West Point, in itself describes a curious episode in West Point life. In the appendix, written by Richard H. Savage, the same episode is referred to, and the infamous persecution to which as a boy the authoress' husband was subjected at West Point is described. Not the least interesting part of the book is Mrs. Boyd's description of her own life in the field, and the trials which she has been obliged to go through.

BEFORE THE GRINGO CAME. By Gertrude Atherton. New York: J. Selwin Tait & Sons. Pp. 306. Price, cloth, $1; paper, 50 cents.

Eleven stories of old California in the days before the discovery of gold, gathered from different magazines, make up this work, which will, no doubt, be found interesting reading for many.

☞ Any of the above books may be purchased through this office. Send for new book catalogue just published. MUNN & Co., 361 Broadway, New York.

SCIENTIFIC AMERICAN BUILDING EDITION.

SEPTEMBER, 1894.—(No. 107.)

TABLE OF CONTENTS.

1. An elegant plate in colors, showing a Colonial residence at Portchester, N. Y., recently completed for Geo. Mertz, Esq. Two additional perspective views and floor plans. An attractive design. Mr. Louis Mertz, architect, Portchester, N. Y.
2. Plate in colors showing a residence recently completed for R. H. Robertson, Esq., at Southampton, L. I. Two perspective elevations and floor plans. A picturesque design and an admirable model for a seashore cottage. Mr. R. H. Robertson, architect, New York City.
3. Residence of Frederick Woollven, Esq., at Rosemont, Pa. Two perspective elevations and floor plans. A neat design in the Colonial style. Cost complete $4,800. Mr. J. D. Thomas, architect, Philadelphia, Pa.
4. A cottage at Roger's Park, Ill,, recently erected for Edward King, Esq. Two perspective elevations and floor plans. A unique design. Mr. Geo. W. Maher, architect, Chicago, Ill.
5. Cottage at Hollis, L. I., recently completed for the German-American Real Estate Co. Two perspective elevations and floor plans. Cost complete $3,200. Mr. Edward Grosse, builder, same place.
6. Perspective elevation with ground plan of Saint Gabriel's Chapel, recently erected at Hollis, L. I. A unique and most excellent plan for a small chapel. Cost complete $6,500. Mr. Manly N. Cutter, architect, New York City.
7. Two perspective elevations and an interior view, also floor plans, of a residence recently erected at Orange, N. J., for Homer F. Emens, Esq. Mr. Frank W. Beall, architect, New York City. A pleasing design in the Colonial style.
8. Perspective elevation and floor plans of a cottage recently erected at Flatbush, L. I., for F. J. Lowery, Esq. Cost complete $4,600. Mr. J. C. Sankins, architect and builder, Flatbush, L. I.
9. A residence at Yonkers, N. Y., recently completed for Mrs. Northrop. A very unique design for a hillside dwelling. Perspective elevation and floor plans. Messrs. J. B. Snook & Sons, architects, New York City.
10. Club House of the Sea Side Club, Bridgeport, Conn. A good example of Romanesque style. Perspective elevation and floor plans, also an interior view. Messrs. Longstaff & Hurd, architects, Bridgeport, Conn.
11. A residence at Hinsdale, Ill., recently erected for C. E. Raymond, Esq., at a cost of $7,000 complete. Perspective elevation and floor plans. Mr. J. H. Shannon, architect, Hinsdale, Ill.
12. The Castle of Bonnetable. Half page engraving.
13. Miscellaneous Contents: The irrigation of laws, illustrated with two engravings.—Viaduct for street railways, Cincinnati, Ohio, illustrated.—The fireproof building construction of the New Jersey Wire Cloth Co., illustrated.—Silvester's remedy against dampness.—Palmer's "Common Sense" frame pulley.—"The Old Hickory Chair," illustrated.—An improved hot water heater, illustrated.—The Caldwell Tower, illustrated.—The American Boiler Co.—The "Little Giant" floor clamp, illustrated.—The Akron air blast furnace.—Laundry glaze.—The "Piqua" metallic lath, illustrated.

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Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information and not for publication.
References to former articles or answers should give date of paper and page or number of question.
Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.
Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.
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Scientific American Supplements referred to may be had at the office. Price 10 cents each.
Books referred to promptly supplied on receipt of price.
Minerals sent for examination should be distinctly marked or labeled.

(6248) W. S. F. writes: In a late number of the SCIENTIFIC AMERICAN, vol. 70, page 86, there was published a formula for solidifying petroleum, pressing into block and baking it. This product was intended for burning, and it was stated that it had many advantages over coal. I followed out the formula, and got the oil in a solid state. On baking it, however, it all crumbled to pieces, rendering it of course unfit to handle or transport it, and on burning it a very dense, black smoke was emitted. Will you please give me some advice on this subject? A. Possibly you baked at too high a temperature or for too long a time. Try the addition of sawdust and clay.

(6249) E. J. asks how to get the gear of a bicycle. A. Count the teeth on the two sprockets. Divide the number on the large or crank shaft sprocket by the number on the driving wheel sprocket and multiply the diameter of the driving wheel by the quotient.

(6250) L. V. H. says: Will you give me a formula for sticky flypaper? A. Resin 1 pound, molasses 3½ ounces, linseed oil 3½ ounces. Boil until thick enough. 2. Also how to treat old files with acid, so they will be partly useful again? A. Boil the files in strong soda and water to clean off all grease, oil or gum. Then dip for a few minutes in a bath of nitric acid 1 part, water 4 parts; the length of time being less on fine files, as your experience may suggest. 3. Will you also state if there is any difference in the working power of a windmill, in hot or cold weather, the barometer pressure and velocity of the wind being the same at each trial? A. There would be little, if any, difference.

(6251) H. C. S. asks how to make a stage dimmer for 30 or 40 lights alternating current. A. Use No. 6 or 7 wire made into a coil with a movable laminated core. The size required depends on the frequency.

(6252) S. T. W. asks for a receipt for making a cement that will cement paper, canvas or leather to a wood or iron pulley to keep belts from slipping. A. Scratch the face of the pulley with a rough file thoroughly, so that there are no bright or smooth places. Then swab the surface with a solution of nitric acid, 1 part; water, 4 parts; for 15 minutes; then wash with boiling hot water. Having prepared a pot of the best tough glue that you can get, stir into the glue a half ounce of a strong solution tannic acid, oak bark, or gallnuts, as convenient to obtain, to a quart of thick glue; stir quickly while hot and apply to the paper or pulley as convenient, and draw the paper as tightly as possible to the pulley, overlapping as many folds as may be required. By a little management and moistening of the paper, it will bind very hard on the pulley when dry, and will not come off or get loose until it is worn out. Use strong hardware wrapping paper.

(6253) W. L. S. says: Please let me know what is the best thing to use on collars, cuffs, and shirts to make them stiff and glossy. A. Starch, 1 ounce; paraffine, about 3 drachms; white sugar, tablespoonful; table salt, tablespoonful; water, q. s. Rub up the starch with soft water into a thick, smooth paste, add nearly or quite a pint of boiling water, with the salt and sugar dissolved in it, and, having dropped in the paraffin, boil for at least half an hour, stirring to prevent burning. Strain the starch and use while hot. Sufficient bluing may be added to the water, previous to the boiling, to overcome the yellowish cast of the starch, if necessary. Spermaceti may be used in place of paraffin. Starched linen can only be properly finished by hard pressure applied to the iron.

(6254) C. H. T. says: Will you kindly let me know in your Notes and Queries of a cheap fixative for charcoal drawing? A. 2 tablespoonfuls of rice boiled in 1 pint or 1½ pint of water; strain, and pass the drawing quickly through the liquid; use a large flat dish for the liquid.

(6255) G. W. C. says: Will you please give me the formula of a solution to remove corns? A. Caustic potassa, 1 drachm; alcohol, 1 fluid ounce. Mix, in a stoppered phial, and agitate until solution is complete. The corns are either moistened with the above or a small piece of lint, or rag, of the size of the corn, is moistened with them and then bound on, care being taken, particularly with the last one, that the liquid does not touch the surrounding parts.

(6256) J. G. R. asks: 1. How many cubic feet of hydrogen and how many cubic feet of oxygen gas can I get in one hour by decomposing water with a battery of 3 volts or 10 volts? A. The gases generated depend on the amperage, not on the voltage directly. The voltage of course is concerned as being the cause of the amperage, the latter depending on the voltage and the resistance of the circuit. 2. If water is decomposed by passing steam through red hot iron tubes, is the oxygen free or will the oxygen unite with the iron? A. The oxygen unites with the iron, and hydrogen only is evolved. 3. If water is heated to such a degree that it will decompose through heat only, will not the mixture of gas unite with a terrific explosion as soon as they are liberated (because the heat is over its kindling point)? A. The gases will unite when the temperature falls below the point of dissociation. They may however be separated to some extent by diffusion through a porcelain diaphragm. 4. Is a living milk white raccoon more valuable than when of common color? A. We should imagine so. Address some menagerie or dealer in wild animals.

(6257) F. W. W. asks: 1. With a current of 500 volts, how to make an electro-magnet that will lift 1000 pounds. That is, the size of helix and of core, and size of wire. A. You should say "potential of 500 volts"—a volt is not a unit of current. A magnet core two inches thick and two feet long would answer. Wind with 20 or 30 layers No. 24 wire; use at least 20 pounds of wire. For magnetic traction calculations and others see Sloane's "Arithmetic of Electricity," $1 by mail. 2. Suppose a bar of soft iron were to be placed so as to rest as an armature upon two or more electro-magnets, would the bar become a magnet throughout its length of equal power as magnet? I presume this would depend on distance between magnets. If so, how far apart may the magnets be placed and retain uniform power of magnet throughout length of bar? A. By placing two north or two south poles in contact with the bar, you can establish consequent poles in its center; the whole bar will show some polarity, but the center will show the most. 3. At what distance from such a magnet would its power be available? You will confer a favor by answering the above. A. Distance reduces the power of a magnet very rapidly. At an inch the attraction would be greatly reduced. No exact answer can be given.

(6258) J. N. P. asks how to separate gold from rubber and the materials to use. It is pure rubber, used to clean from my work waste gold leaf, that I use. A. We would suggest metallic mercury to remove and save your gold. An amalgamated copper plate might be used. Scrape off the amalgam from time to time, distill off the mercury, and gold will be left.

(6259) W. J. H. asks what effect an inductive load has upon the speed of a Shallenberger meter, such as is used in houses on incandescent light circuits. Westinghouse A. C. system. A. The Shallenberger meter indicates the amperage of the current. Anything which reduces the current will reduce its speed.

(6260) H. S. B. asks: What is the potential necessary to cause a spark of ⅛ inch? A. Perhaps 12,000 volts. No really reliable figure can be given.

(6261) C. B. W. asks: 1. How much No. 26 magnet wire is required to give 50 ohms resistance? A. Allow 2·35 feet to one ohm. Multiply the ohms desired by this, and the product gives the feet—117·5 feet in your case. 2. How many lamps are required to be placed in a circuit to have a motor run from 100 v. 10 amperes if the motor is wound for 50 volts? A. You must give the amperage of the motor. For each ampere required for the motor, use four 100 volt lamps in parallel.

(6262) W. J. W. asks: 1. Why is peroxide of manganese, also chloride of lime, placed around the carbon in the Leclanche cells? A. To act as a depolarizer and dispose of the hydrogen which tends to accumulate on the carbon. 2. Does it make any difference if a zinc rod is used in place of a sheet, and which is best? A. A rod is less liable to corrode and fall into pieces than a sheet. One is as good as the other from the electrical point of view. 3. Why is water so conductive to an alternating current, and offers such great resistance to a continuous one? A. Water is no more conductive, properly speaking, to one than to the other. 4. What is the object in having such great variations in the resistance of telegraph instruments, being all the way from 20 to 200 ohms? A. It depends on the resistance of the line. A line of high resistance requires higher resistance instruments. 5. Please state the number of volts and amperes generally carried on an electric street car line? A. 500 volts; amperes variable, depending on the number of cars operated at once.

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AND EACH BEARING THAT DATE.

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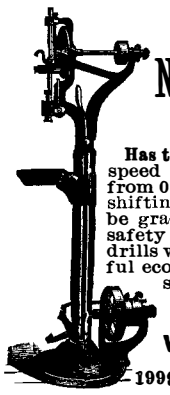

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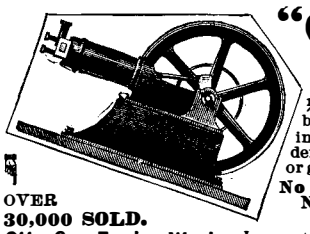

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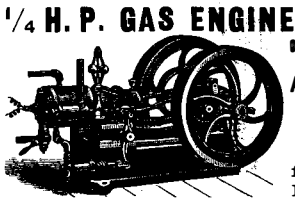

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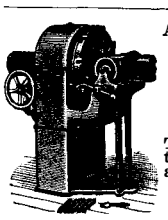

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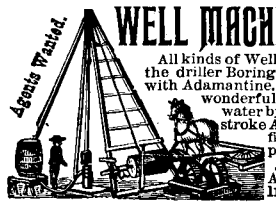

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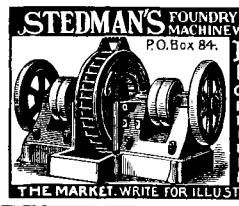

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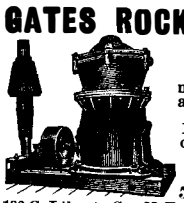

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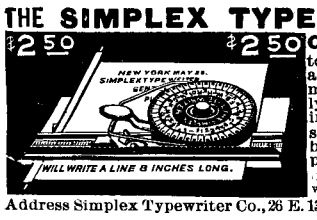

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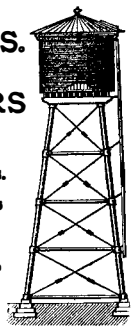

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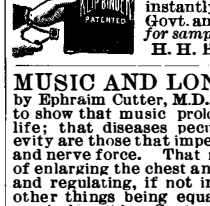

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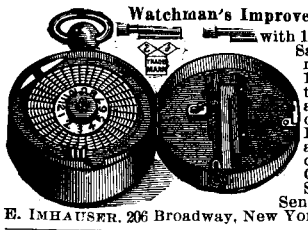

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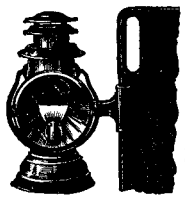

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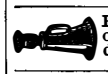

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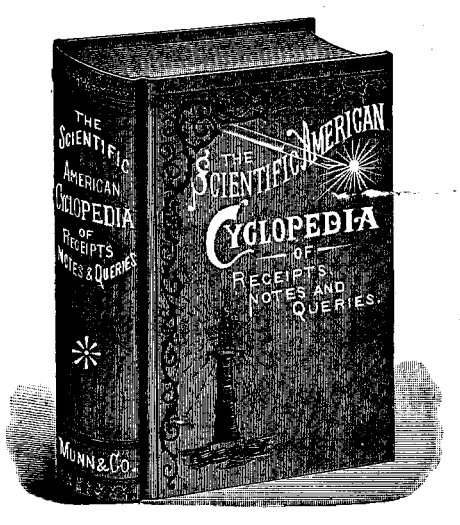
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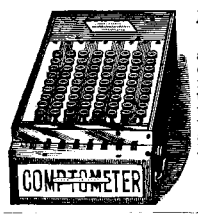

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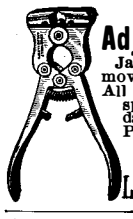

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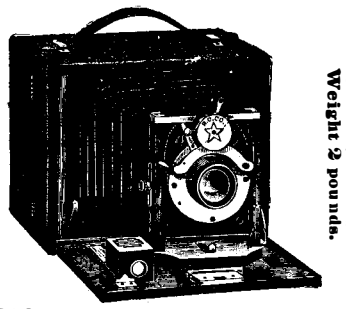

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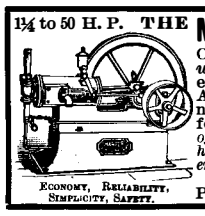

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